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Chemical Management Services - Focused Studies:
Part 1 - CMS in Small and Medium Enterprises
Part 2 - A CMS "Standard"

Thomas J. Bierma
Frank L. Waterstraat

Illinois State University

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Part 2 – A CMS "Standard"

Thomas J. Bierma
Frank L. Waterstraat

Illinois State University
Normal, Illinois

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Champaign, IL 61820

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Abstract

This report covers two aspects of efforts to increase adoption of chemical management services (CMS). The first is expansion of CMS into small and medium enterprises (SMEs). The second is reducing uncertainty among chemical users through a CMS "standard."

Small and medium enterprises (SMEs) have a significant need for chemical management services (CMS). However, financial barriers make traditional CMS programs unprofitable in smaller accounts. To overcome these financial barriers, CMS suppliers must enhance their revenues and reduce their costs, as well as overcome a number of non-monetary barriers. This will require significant changes in CMS programs for SMEs. Governmental and non-profit organizations can assist in this process. Specific recommendations are provided for CMS suppliers and other organizations interested in promoting the adoption of CMS. A case study provides an example of how a CMS supplier engaged a small facility in a profitable CMS account.

One of the greatest barriers to diffusion of CMS is customer confusion and uncertainty about how CMS differs from other chemical supply programs. A CMS "standard" is one way to reduce customer confusion and give CMS a competitive advantage over less economically- and environmentally-beneficial programs. A review of existing standards in other industries reveals five basic dimensions that must be considered in structuring a CMS standard. Three alternative structures for the CMS standard are proposed.

Executive Summary

Part 1: Strategies for CMS in Small and Medium Enterprises (SMEs)

Traditional Chemical Management Service (CMS) programs are generally not profitable in facilities with relatively small chemical purchases (under about $ 1 million/year). However, such facilities often have an even greater need for CMS than larger plants, due to limited resources for environmental management and process improvement.

The greatest barrier to CMS in SMEs is financial – traditional CMS programs are not profitable in SMEs. This is because the CMS fee is generally limited to the amount previously spent by the SME on chemicals. Thus, the smaller the previous chemical buy, the smaller the CMS fee. CMS supplier costs, however, do not vary proportionally with the size of the chemical buy. The combination produces a “break-even” point – about $1 million for many CMS suppliers – where the size of the chemical buy no longer provides supplier profit.

To bring CMS into smaller manufacturing operations, means must be found to increase CMS supplier revenue, decrease CMS supplier costs, and overcome a number of non-financial barriers. Below are recommendations to make CMS more successful in small and medium enterprises:

1. Aggressively develop new chemical-minimizing technologies.

CMS suppliers need to aggressively pursue new technologies that can reduce plant chemical usage by 80-90%. In part, this can be accomplished through partnerships with research organizations such as WMRC. These technologies should be broadly applicable to an array of SMEs with minimal additional research and development. The goal is to produce dramatic reductions in chemical costs while minimizing research, capital, and operating costs for the technology.

2. Develop and market broader value-added services as part of the CMS package.

The chemical spend of SMEs is not large enough to make traditional CMS programs profitable. CMS providers must enhance revenues by offering greater value-added services that reduce chemical-related costs and "headaches" for the SME. Targeted costs, "headaches" and potential services could include:

- Waste treatment and disposal costs – including management of waste treatment operations.
- Equipment and tool life – including purchase and management of tools.
- EH&S costs and "headaches" – including management of EH&S services (reporting, MSDS management, training, etc.)
- Product quality/scrap/rework costs
- Clean-up and spill management costs
- Energy costs
- Process downtime

- ISO 14001 certification assistance
- Process engineering services

3. Develop case studies and “demonstration sites” so that SME managers can “observe” successful CMS programs.

   Once a SME manager is initially interested in CMS is it necessary to reduce risk to the point that they are willing to develop an RFP and work with prospective suppliers to produce viable proposals. This means overcoming typical skepticism about the effectiveness of CMS, its compatibility with existing work practices, and the trustworthiness of its suppliers. This is probably best done by allowing managers to “experience” CMS through case studies and demonstrations sites that require a minimal upfront investment of time and money.

4. Develop technologies and work practices to allow CMS programs to succeed with only part-time staff.

   CMS programs in SMEs can be profitable only with part-time staff. This limited staff time should be focused primarily on process improvement. Thus, technologies and work practices are needed to accomplish basic maintenance and operation activities with a minimum amount of CMS staff time. This could include remote process monitoring, training of plant staff, etc.

5. Third-party organizations could facilitate the solicitation of CMS proposals.

To help SMEs overcome the learning curve with CMS, third-party organizations, such as WMRC, can assist through at least two activities. First, they can compile a list of companies, with relevant information and references that are interested in providing CMS proposals. Second, upon request and funding from an SME, the organization could help the SME develop an RFP to solicit proposals.

6. Explore innovative pricing strategies for CMS in SMEs.

Traditional CMS pricing, using a fixed fee, may be viewed by SME managers as a radical and risky departure from normal supply arrangements. Innovative pricing strategies – such as pass-through of chemical costs, a small management fee, plus gainsharing – should be explored to reduce perceived risks.

7. Study SMEs to identify the relevant chemical-related needs.

To get the attention of busy SME managers, marketing messages must be in managers' language. Interviews, focus groups, or similar methods should be used to thoroughly understand the chemical-related needs of SME managers and be able to express this in the language and culture of the mangers.

8. Conduct third-party outreach to SMEs about CMS.

Third-party organizations can promote the diffusion of CMS by performing critical outreach. Government organizations, such as state and federal environmental agencies, have a wide array of outreach channels available, from conferences to newsletters to compliance agreements. Articles and editorials in periodicals are also a valuable way to reach SMEs and others with information about CMS.

Part 2: A CMS "Standard"

The greatest barrier to diffusion of CMS is customer confusion and uncertainty about how CMS differs from other chemical supply programs. An effective CMS standard is needed to reduce customer confusion and give CMS a competitive advantage over less economically- and environmentally-beneficial programs.

Based upon analysis of the five dimensions of standards, we recommend the following three options, in priority order:

1. **Customer-driven Standard** – The CMS standard would be authored by a group of current CMS customers and verified by prospective CMS customers. It would be a standard product definition, identifying the essential elements of successful CMS programs. The standard would be voluntary, though it could be mandated as part of

negotiated consent agreements. This approach offers relatively high standard credibility and relatively low cost.

2. **USEPA Environmental Technology Verification (ETV) Program** – A CMS supplier would submit a specific CMS program to USEPA for verification through the ETV or similar program. Other CMS programs offered by that supplier would be covered by the verification, provided the essential elements of the program did not change. Over time, the essential elements of various suppliers' programs could be used to fashion a more comprehensive standard. It would be a product performance standard, authored and verified by the government. The standard would be voluntary, though it could be mandated as part of negotiated consent agreements. This approach will require more time and resources for the verification process.

3. **Supplier-driven Standard** – The CMS standard would be authored by a group of CMS suppliers and verified by either prospective CMS customers or by third-parties such as WRMC. It would be a standard product definition, identifying the essential elements of successful CMS programs. The standard would be voluntary, though it could be mandated as part of negotiated consent agreements. It would have relatively low costs, but may not have the credibility of a customer-drive standard.

Part 1:

Strategies for CMS in Small and Medium Enterprises

Chapter I

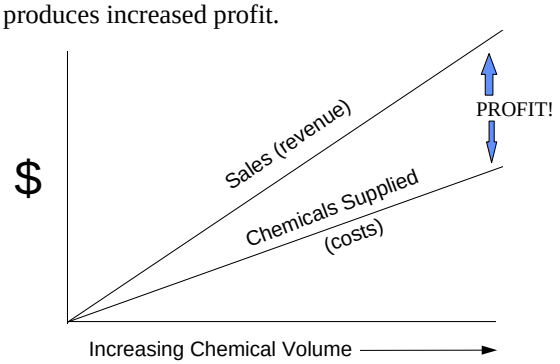
CMS in Small and Medium Enterprises

Introduction

Chemical Management Services

Chemical Management Services (CMS) is an innovative chemical supply strategy that has dramatically reduced chemical waste and chemical cost for many companies. It does this by aligning the financial incentives for both chemical supplier and chemical user (Bierma and Waterstraat, 1997, 2000).

Figure 1-1. Traditional chemical supply relationship from the supplier's perspective – increased volume produces increased profit.

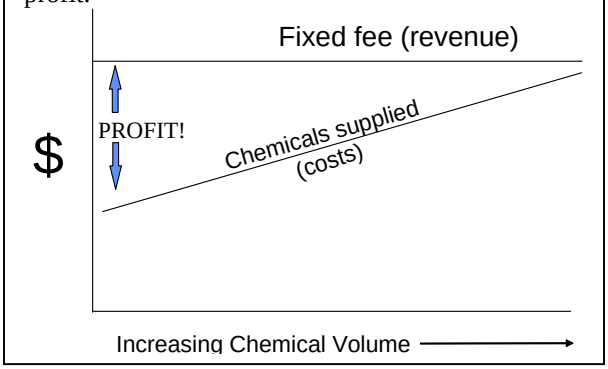


In traditional chemical supply relationships, the supplier increases profit by increasing the volume of chemicals sold (see Figure 1-1). The supplier is continuously driven to increase chemical sales to increase profit. Aside from promoting waste, this "volume conflict" creates an inherent adversarial relationship that inhibits the free flow of information related to the efficient application of chemicals from the supplier to the buyer that could reduce the buyer's chemical usage and costs. Subsequently, it creates a degree of mistrust between buyers and suppliers, reducing the ability of both parties to work together to improve the total financial potential of the relationship.

A chemical management services (CMS) program, however, is very different type of business relationship. In a CMS relationship, financial incentives align the supplier's performance goals with those of the chemical buyer. The supplier's goal is to continuously reduce chemical use and waste while continuously improving product and process quality. The supplier and the buyer then "share the savings" gained from reduced chemical volume and improved processes. To achieve these chemical efficiencies, the responsibilities associated with all aspects of chemical management program in a given plant are shared between the two parties based on respective core competencies. The buyer defines chemical performance specifications and the supplier takes direct responsibility for insuring the chemical performance meets the standards.

In most CMS programs the chemical buyer pays a fixed fee (per month or per unit of production) to the supplier. The supplier agrees to meet the "chemical performance needs" of a plant . Since the supplier's revenues are fixed, the supplier has a financial incentive to reduce chemical costs in order to increase profits. Chemical related cost reductions come primarily through improvements in chemical management and chemical use efficiency. As shown in Figure 1-2, the cost reduction incentive aligns the interests of the chemical supplier with the interests of the

Figure 1-2. CMS relationship from the supplier's perspective – *decreased* volume produces increased profit.



chemical buyer - to drive chemical volumes down. This is just the opposite of the typical chemical sales relationship (Figure 1-1). Simply stated, CMS turns the inefficiency and waste of traditional chemical sales relationships into profit for both the chemical supplier and chemical buyer.

The Need for CMS in Small and Medium Enterprises

Adoption of CMS in small and medium enterprises (SMEs) poses a fundamental dilemma: traditional CMS programs are not profitable, yet smaller companies need CMS even more than larger companies because they do not have the resources to effectively manage and use chemicals. One CMS supplier summarized the need this way:

> *"The needs are greatest in small shops. They don't have the resources for their own chemical management and environmental programs. They have poor economies of scale and relatively high chemical costs."*

The impact that SMEs have on the environment is significant. In Illinois, 89% of manufacturing establishments have fewer than 100 employees (U.S. Census Bureau, 2000). Yet these establishments use many of the same chemicals and generate many of the same wastes as larger establishments. The difficulty faced by SMEs in complying with environmental, health, and safety regulations is evident from the variety of small business assistance programs that have been initiated by both state and federal regulatory agencies.

Moreover, CMS suppliers report considerable interest in CMS programs among smaller chemical users. However, due to the barriers presented below, few successful CMS programs have been implemented in these smaller accounts.

Research Purpose and Methods

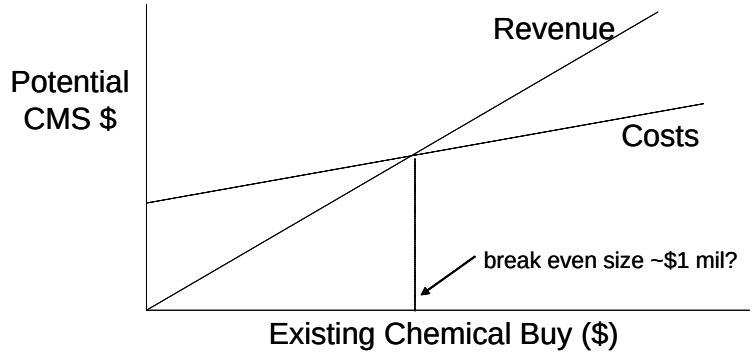
The purpose of this research was to identify the primary barriers to CMS in SMEs as well as the most promising strategies for overcoming those barriers. The research was conducted primarily through interviews, by phone and in person, with both SME managers and CMS suppliers. In the ananlysis, emphasis was given to those findings that were identified through multiple sources, particularly when evidence was provided by both SME managers and CMS suppliers. In addition, an in-depth case study was compiled from interview data collected on a successful CMS program in a small chemical account. Interviews were conducted not only to identify the reasons for success, but also the process through which CMS program was implemented and how the SME and supplier overcame the barriers to CMS. A literature review was also used to place CMS barriers in context with other challenges facing SMEs.

Barriers to CMS in SMEs

Financial Barriers

The fundamental challenge of implementing CMS in small chemical accounts is overcoming the financial barriers faced by CMS suppliers (Figure 1-3). In a standard CMS program, revenue for the supplier is relatively fixed, as either a flat monthly fee or unit price. In setting this fee, chemical buyers typically negotiate from the perspective of their past chemical purchase experience; most buyers resist paying more for CMS than they were paying for chemicals. Thus, gross revenue for the CMS supplier often approximates the previous chemical buy (or perhaps a bit less). This is indicated in Figure 1-3 by a straight line for revenue that passes through the origin of the graph.

Figure 1-3. The financial outlook for the CMS supplier with regard to potential CMS accounts.



CMS supplier costs, however, do not vary in direct proportion to plant's previous chemical buy. To understand why, consider that most CMS supplier costs are composed of the following:

Marketing Costs – winning the account.
Research Costs – identifying process improvements at the account.
Capital Costs – implementing improvements at the account.
Operating Costs – maintaining the account (includes both personnel and chemical costs).

In Figure 1-3 these costs are depicted as a line with "flatter" slope than that of revenue. For example, with marketing costs, the cost of winning a small account can be almost as significant as the cost of winning a large account. Both require numerous sales contacts, plant walk-throughs, proposal development, presentations, and contract negotiations. The same is true for research costs. The cost of researching potential improvements to a 500-gallon machining fluid system can be nearly as much as researching improvements for a 50,000 gallon system. Capital costs, though typically lower for smaller systems, are usually not proportionately lower. Operating costs also do not vary directly with the size of the chemical account. Management of chemical information, inventories, quality, and other aspects of the program must be performed no matter how large or small the volume of chemicals.

The result is that the CMS supplier's profit is limited by the size of the previous chemical purchase. Large chemical accounts offer significantly greater profit opportunities; revenues are relatively high, yet costs, due to economies of scale for the supplier, can be relatively low. As the size of the chemical buy decreases, CMS revenues drop rapidly, but not the costs. At some point, the CMS supplier reaches a break-even point. No profit can be made below this break-even

point. Based on discussions with a number of CMS suppliers, this break-even point appears to be about $1 million per year for most accounts. Below the $1 million dollar account value (which likely includes the vast majority of Illinois manufacturing establishments) the supplier would not make money using a traditional CMS program approach.

Other Barriers

In addition to the financial barriers discussed above, suppliers face a variety of the other barriers, many of which are common in larger accounts (Bierma and Waterstraat 2000, 2001). These are discussed briefly below:

Buyer Confusion – CMS employs a different customer relationship from the typical approach to purchasing process inputs. At first, this customer relationship can be difficult for SME managers to understand. This problem is compounded by the lack of a standard definition for CMS. Many chemical suppliers offer so-called "chemical management" programs that are little more than standard supply programs with a few added services. These CMS programs are inferior substitutes. This situation leads to significant confusion on the part of uninformed buyers, and creates challenges for CMS suppliers with legitimate CMS programs to distinguish their programs from those of their competitors. SMEs are at a greater disadvantage since they lack the time and resources to research and compare chemical supply programs.

Hidden Costs – The value of CMS lies in its ability to reduce total chemical costs. Examples of such costs are listed in Table 1-1. Unfortunately, most of these costs are "hidden"; that is, it is difficult for SME managers to identify these costs or to link them to chemical usage. If management cannot easily determine the total cost of chemicals, they cannot accurately assess the financial benefits of a CMS program. In one respect, SMEs are less vulnerable to this problem than larger accounts, since it is easier for management to see the "big picture." SME managers are sometimes better able to identify how different decisions impact processes within the facility. However, SMEs often lack the cost accounting information that would allow them to link chemicals to the related "hidden costs" and the hidden value of CMS.

Table 1-1. Examples of "Hidden" Chemical Costs

Logistic	**Application**
Chemical purchasing system management	Value of material in waste
Inventory management	Equipment and tool life
Chemical handling	Lost production time from poor chemical quality and incompatibility
EHS/compliance	Lost production time from chemical handling and maintenance
Waste treatment	Product defects from poor chemical quality and incompatibility
Waste disposal fees	
Environmental compliance	
Health and Safety compliance	
Insurance	
Liability	
Keeping up-to-date with regulations	
Labor concerns about health and safety	

Variable Production – Production processes that vary in terms of production rate and/or type of product produced create a significant barrier for CMS applications. Varying production rates and/or products result in variations in chemical usage making it difficult for the supplier to determine appropriate CMS fees, improvements in chemical processes, and reductions in chemical-related costs. Unfortunately, many smaller facilities are plagued with highly variable production processes both in terms of rates and products.

Unrealistic Expectations – In some large accounts, CMS providers can offer immediate cost savings of 10 -15% over the plant's previous chemical purchase. This is a by-product of the economies of scale that can be achieved in some large accounts. Managers of smaller facilities who have heard about CMS often expect the same type of up-front cost reductions. However, as discussed above, this is unrealistic in small accounts. In fact, initial CMS fees will generally exceed the cost of the previous chemical purchase. SME managers may also expect the supplier to provide full-time on-site support from a chemical manager, as provided to large accounts. However, as illustrated above, this is not financially possible in a SME program.

Lack of Trust – In interviews with small business managers, we frequently heard some variation on the old phrase "the fox guarding the hen house" in reference to CMS programs. A number of CMS suppliers confirmed that this is a common perception among SME managers at both small and large facilities. Though properly structured CMS programs provide a *disincentive* to increase chemical volume, many managers assume that involving the supplier in chemical decisions will work against the interests of the plant - the supplier will make decisions in the best interest of the supplier not the SME.

Resistance to Cross-functional Cooperation – CMS requires a number of important changes in business operations that many companies find difficult. One change is that CMS requires cooperation across business units, particularly with regard to budgets (Bierma and Waterstraat 2000). The cost of making chemical process improvements may impact one division's budget (such as manufacturing) while the savings may impact another division's budget (such as environmental management). This type of teamwork requires active involvement of upper management. Another important change is the evaluation of purchasing department's performance. The traditional approach of expecting reductions in purchase price, must be replaced by expectations to reduce total chemical costs. In some ways, these changes may be easier to accomplish in small facilities since the management structure is smaller, communication is more direct, and the relationships are more personal.

For CMS to work in SMEs, strategies must be developed to overcome the financial barriers and make CMS profitable for the supplier. In addition, other barriers, as discussed above, often must also be overcome. We begin by addressing the financial barriers and then discuss the other barriers.

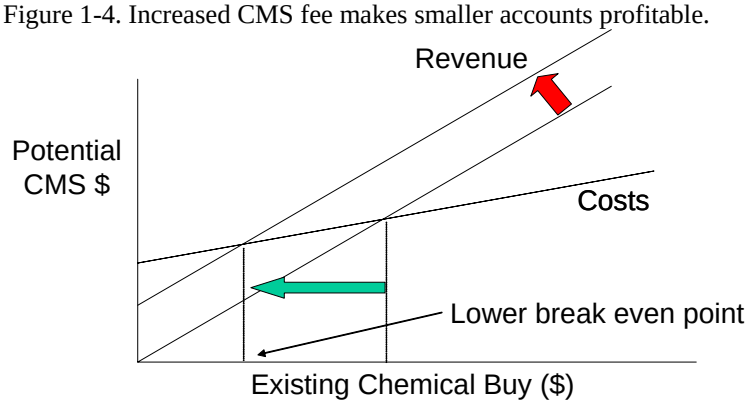
Increasing Revenue for CMS Suppliers

The concept is simple, to make CMS profitable in smaller accounts, suppliers must either increase revenues, reduce costs, or both. We begin with a discussion of how to increase revenues. In our interviews with CMS suppliers conducted as a part of this research, all successful CMS programs with smaller accounts were supported by a CMS fee that was in excess of the previous chemical purchase. The SME managers were paying more for CMS services than they had previously spent on purchasing chemicals.

From the perspective of the supplier, obtaining a CMS fee in excess of the previous chemical purchase promotes profitable CMS programs in smaller chemical accounts. This can be seen in Figure 1-4 as the revenue line shifts upward (a higher fee for the same previous chemical buy), the break-even point shifts to the left.

For CMS buyers to pay a fee greater than the cost of their previous chemical purchase, the supplier must focus on reducing other chemical-related costs in the plant. For this to occur, the buyer must understand the hidden costs and believe that CMS will reduce those costs. Some chemical-related costs can be quantified, while others are perceived by buyers as "headaches" related to production issues that can not be avoided. Below, we explore some examples of each.

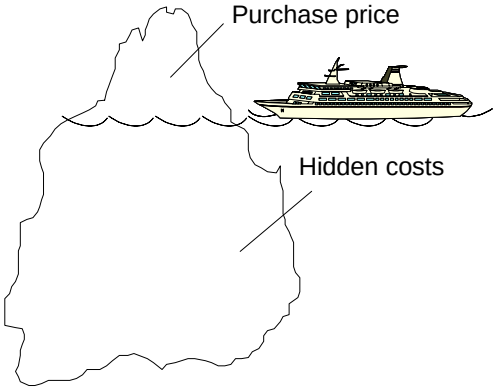
Figure 1-4. Increased CMS fee makes smaller accounts profitable.



Reducing Quantifiable SME Costs

A useful way to visualize chemical-related costs is an iceberg (Figure 1-5). The tip of the iceberg represents the chemical's original purchase price. The bottom of the iceberg represents all the other costs that are incurred in order to purchase, use, and dispose of the chemical. These costs are often "hidden;" they appear in overhead accounts or are allocated throughout the organization in accounts that most managers fail to recognize as associated with chemical use (see Table 1-1). The ratio of chemical hidden costs to purchase price has been estimated to range from 1:1 to 7:1 (spending $7 to manage a chemical for every $1 in chemical

Figure 1-5. The hidden costs of chemicals are like the hidden portion of an iceberg.



purchases)(Mishra 1997, Votta, et al 1998). In our recent research on hidden costs of metalworking fluids, we found ratios of 1.5:1 to 5.5:1, not including costs related to tool life, product quality, and process downtime (Bierma and Waterstraat forthcoming). Clearly, these "hidden" chemical-related costs offer significant opportunities for CMS suppliers to bring greater value to SMEs in return for a higher management fee.

Based upon our interviews with CMS suppliers and our recent research on hidden chemical costs, we have identified a number of cost areas that appear to be most promising for CMS programs. These are listed in Table 1-2 and discussed briefly below.

Table 1-2. Examples of potentially quantifiable chemical-related costs in SMEs.

- Waste treatment and disposal costs
- Equipment and tool life
- Product quality/scrap/rework
- Clean-up and spill management
- Energy costs
- Process downtime

Waste Treatment and Disposal – In the SME case study presented in Chapter 2 of this report, the CMS supplier was able to implement a profitable CMS account by including waste disposal costs into the CMS program. Disposal costs had been approximately equal to the chemical buy. This effectively doubled the potential revenue from the account. Also, in one of the plants we studied in our research on hidden chemical costs, we identified waste disposal costs of more than 50% of the annual metalworking fluid purchases (Bierma and Waterstraat, forthcoming).

Equipment and Tool Life – Equipment and tool life are often significantly affected by the chemicals used in the manufacturing process. This relationship is most obvious with metalworking fluids and the life of machine tools. Our research at three SMEs indicated that a 20% increase in machine tool life could produce as much as a 4:1 financial benefit for the company (Bierma and Waterstraat, forthcoming). That is, the company could realize four dollars in tool cost savings for every dollar in metalworking costs. This provides a potentially significant pool of additional revenue for CMS suppliers. In fact, one of the CMS suppliers we interviewed implemented a program where they supply both chemicals and machine tools to the buyer. By including both the chemical and tools in the program, the CMS supplier was able to make the SME account quite profitable through significant tool savings.

Product Quality and Equipment Downtime – In addition to extending the life of equipment, chemicals can affect equipment performance. Equipment performance impacts product quality, the costs resulting from scrap and rework, and lost production due to equipment downtime. In a "gainsharing" arrangement between one CMS supplier and four SME plants (discussed below), savings from reduced downtime, scrap, and rework were shared with the supplier. This arrangement provided a significant enhancement to supplier revenue. In one plant, scrap costs were reduced 87%.

Clean-up and Spill Management – The use of some chemicals, particularly metalworking fluids, can produce significant clean-up expense. For example, one of the plants studied spent twice as much on fluid clean-up as they did on the purchase of metalworking fluids

(Bierma and Waterstraat, forthcoming). Most of the clean-up costs were due to the purchase and disposal of absorbent products and the laundering of uniforms, shop towels and rugs.

Energy – In some cases, chemical distribution within the plant requires a significant expenditure for energy. For example, one of the plants we studied used a large central sump system to distribute metalworking fluids to more than 50 grinding machines. Pumping fluid from a basement sump to first-floor machines produced electricity costs almost equal to the annual spend on the grinding fluid (Bierma and Waterstraat, forthcoming).

Resolving "Headaches"

Table 1-3. Examples of chemical-related "headaches" for SMEs (costs that may not be easily quantified.)

- Reliable chemical inventory
- Chemical tracking
- Environmental regulatory compliance and reporting
- Health and safety issues, including management of MSDSs.
- Engineering or environmental services.
- Managing water or wastewater treatment operations.
- Product quality
- Process downtime

It is important to note that reductions in total chemical cost can include benefits that are not easily monetized; or what many managers would simply refer to as "headaches" (Table 1-3). In the CMS case study presented in Chapter 2 of this report, management recognized that CMS not only reduced waste disposal costs (which can be monetized) but also help solve product quality problems, reduce production down-time and eliminate chemical odors. Management could not monetized these benefits, but recognized them as significant production "headaches" that were resolved. Resolution of these headaches played an important role in the decision of plant management to pay a fee for CMS that was well in excess of the previous chemical purchase. The additional expense for CMS was clearly justified, in the minds of management, because these production headaches were reduced.

In some ways, management "headaches" may offer a better rationale for increasing CMS supplier revenue than actual cost reductions. In a number of our interviews, SME managers stated that the resolution of production headaches was much more significant to them than potential savings.

Reducing Costs for CMS Suppliers

Reducing costs for the CMS supplier will make smaller accounts more profitable and potentially a more desirable market. This is indicated in Figure 1-6. As the cost line shifts down, the break-even point shifts to the left. As discussed, CMS suppliers have four cost categories to target for reduction. Each is discussed in more detail here.

Marketing Costs – winning the account.

One strategy that has been used with success to reduce marketing costs is to service several small facilities that belong to the same company. If the program can be sold at the corporate level and implemented at several facilities, marketing costs are reduced significantly. In our discussions with suppliers, we uncovered four cases in which smaller facilities (under $1 million chemical buy) were successfully serviced under single corporate contracts.

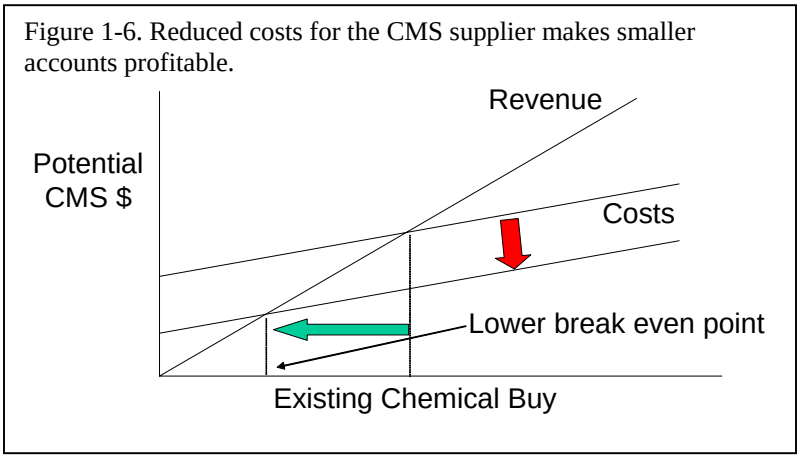


Figure 1-6. Reduced costs for the CMS supplier makes smaller accounts profitable.

However, individual facility managers are not always willing to accept or cooperate with corporate purchasing decisions. In many cases, facility managers have the authority to make independent decisions regarding chemical management, even though it has been accepted at the corporate level. In this situation marketing costs will not be reduced. Furthermore, the vast majority of SMEs are not part of a large corporation. Thus, additional strategies to reduce marketing costs must be considered as well.

One alternative approach is to form buyer "co-ops" in which a group of independent small businesses form an association with the intention of purchasing group CMS services. Buying co-ops have been successful in other industries with farming being perhaps the most well known. However, there is a problem with the co-op approach to CMS. Co-ops are most financially successful in the volume purchasing of commodities, such as fertilizer or pesticide. Customization of these chemicals is not required. The critical factor for the individual farmer is price, and this is the co-op's advantage - it has leverage. However, CMS requires the provision of customized services. An experimental co-op of small manufacturers in the Pittsburgh area had great difficultly negotiating a single CMS agreement that met the needs of all SME members. Ultimately, no CMS contract was awarded (Whaley, 2002).

Reducing marketing costs is an area in which governmental and non-profit organizations can play a supportive role. Though most SME contracts need to be sold on an individual basis by CMS suppliers, other organizations can significantly reduce the time and effort required to close an account. As one supplier stated:

> *It currently takes about 12-18 months of marketing to win a CMS account. If that time could be cut to 6 months, CMS would become more accessible to smaller facilities.*

Part of a supplier's marketing time is spent selling CMS as a concept. The remaining time is directed to selling the advantages of a given supplier over the competition. Government and non-profit organizations can help to reduce marketing time by addressing the first marketing task - selling the CMS concept. This is the primary goal of the CMS Forum, a non-profit organization of CMS suppliers, CMS users, governmental agencies and universities (CMS Forum 2003). They promote CMS by publishing articles in trade journals, making presentations at trade association meetings, and hosting international workshops on CMS each year. However, federal, state, and local governmental organizations can also play a more prominent role. Increased funding for CMS research and outreach to smaller businesses can achieve greater diffusion of CMS programs.

Other CMS promotion strategies do not require funding. Regulatory agencies could recognize CMS programs as evidence of "due diligence" by manufacturers in any future legal action. Even promoting the benefits of CMS as a method to achieve regulatory compliance, or avoid certain regulations altogether, can be beneficial to improving the diffusion of CMS.

Research Costs – identifying process improvements.

The greatest value that a CMS program offers a plant is the potential for process improvements. These improvements can range from more effective chemical inventory management to manufacturing practices using new chemicals or technologies. However, it takes time and resources to research, develop and implement process improvements.

The best approach to reducing these research costs is to develop new chemical technologies that can be applied in a wide variety of plants with minimal modification. For example, some CMS suppliers have developed chemical tracking software that can be applied in almost any plant with very little customization. Some CMS suppliers have also been successful in applying basic fluid management practices in a wide variety of process applications. Partnerships between CMS suppliers and other governmental and private entities, such as technical assistance programs and, equipment suppliers can help reduce research costs.

This is another area where governmental funding can promote chemical reductions. Improved materials and technologies developed through government-funded research programs can be rapidly deployed through CMS programs if CMS suppliers can be encouraged to participate in such programs.

Capital Costs – implementing improvements.

Reduction of the capital expenditures required to implement process improvements can be achieved through the same activities outlined above for reducing research costs. Developing technologies with broad application potential through partnerships with equipment suppliers and technical assistance programs can make these technologies less expensive.

Operating Costs – maintaining the account (personnel and chemical costs).

In CMS programs, the cost of chemicals is the responsibility of the supplier, not the buyer. Process improvements that reduce the volume or cost of chemicals required to meet production goals can significantly improve supplier profitability. Chemical costs are best controlled by finding opportunities to make a significant reduction in the chemical volume required by the process. Evidence from larger CMS accounts suggest that chemical reductions of 50% or greater are not uncommon.

However, there is reason to believe that chemical reduction opportunities remain under-exploited. Many new technologies, such as membrane filtration, offer promise in reducing the volume of chemicals required by more than 80% (Lindsey, 1997; WMRC, 1998). Yet the application of membrane filtration and many other technologies has not been aggressively pursued by CMS suppliers.

This is another area in which governmental support can help increase the diffusion of CMS. Many of these technologies require significant preliminary research and development efforts to identify the benefits and "de-bug" any application problems. The research capabilities of WMRC and similar governmental agencies can facilitate this research and assure that research results are widely distributed, making the new technologies available to all CMS suppliers.

In addition to chemical costs, personnel costs are a significant component of CMS operating costs. Traditional CMS programs usually have one or more full-time, on-site chemical managers. These individuals are responsible for monitoring the production process and implementing process improvements. Utilizing full-time personnel is not cost-effective for the supplier in smaller accounts. Both work practices and technical applications are needed that allow supplier personnel to service a small CMS account on a part-time basis, while controlling the processes and implementing the improvements needed to make the CMS program successful. Again, this is an area in which WMRC and similar organizations can play an important role.

Geographic clustering of plants is a promising strategy for efficiently using CMS personnel time. This allows one chemical manager to service several plants with minimal travel time. This is only possible in areas that have a high density of SME manufacturing plants. One supplier we interviewed was successfully able to service four smaller facilities in the region of Northeastern Illinois/Southeastern Wisconsin. Thus, it appears that geographic clustering is promising in metropolitan areas where suppliers already have accounts and can add plants to the cluster on an individual basis.

Overcoming Other Barriers

CMS Marketing

A number of the barriers discussed previously involve misconceptions or lack of understanding on the part of chemical buyers. Improved CMS marketing materials can help to overcome these information barriers. Our previous research identified CMS marketing needs and opportunities for larger accounts (Bierma and Waterstraat, 2001). Below, we briefly summarize some of the opportunities applicable to SMEs.

Use a CMS "Standard" – The chemical buyer's lack of knowledge has resulted in confusion over the definition of CMS and has allowed a variety of chemical supply programs such as "integrated supply, "e-commerce," and "leverage buying" to be marketed as CMS. Part 2 of this report provides recommendations on how the CMS industry can develop an appropriate CMS "standard definition".

Address Hidden Chemical Costs – Marketing materials should "highlight" the hidden costs associated with chemical use. Our research on metalworking fluid "Total Cost of Ownership" and other studies of hidden costs can be used to develop marketing materials aimed at informing SME managers. (Bierma and Waterstraat, forthcoming)

Promote Realistic Expectations –Marketing materials can assist SME managers with understanding the economics of CMS and how suppliers can make a profit. All promotional materials must be clear that large chemical accounts can achieve significantly greater savings. Yet it should also be clear how SMEs can profit from CMS. Marketing materials targeted specifically to the SME market can emphasize the realistic expectations for CMS programs.

Reducing CMS Risks

A number of other barriers relate to potential risks for both the CMS supplier and the buyer. Several techniques may be used to reduce uncertainties.

Innovative Pricing Arrangements – New CMS pricing arrangements may be able to reduce risks for both the customer and supplier. One CMS supplier has been using an innovative pricing strategy with four of its smaller accounts. Instead of the standard fixed fee pricing, this supplier used a combination of:

- *Chemical cost pass-through* - price of chemicals passed through to the buyer – generally somewhat below the price previously paid by the buyer.
- *CMS management fee* (usually very small) – the fee was used to offset purchasing, inventory management, and other basic services provided by the supplier.
- *Gainsharing* – an agreement to split the savings derived from process improvement projects.

In the four plants currently using this approach, the supplier has reported "numerous checks" under the program for improvements such as reduced downtime, scrap, and rework. In one particularly successful program, the supplier reduced scrap costs by 87% and was able to share in those savings with the SME.

This CMS strategy reduces risks for the buyer and the supplier. For the buyer, the "pass-through fee plus management fee" arrangement is not a radical departure from the traditional way of buying chemicals. In addition, aside from gainsharing, the cost is similar to the cost of the previous chemical purchase. For the CMS supplier, this guarantees that basic costs are covered yet provides a significant financial reward for developing and implementing cost-saving initiatives.

Demonstration Sites – It is well established that adoption of an innovation can be significantly enhanced when the adopter is able to "experience" the innovation before adopting (Rogers 1995, Lindsey 1999). The Illinois Waste Management and Research Center (WMRC) has had success in using selected SMEs as demonstration sites for new pollution prevention technologies through their ADOP2T program (WMRC, 2002). The CMS industry can work with WRMC and similar agencies to apply this successful strategy to CMS.

Third-party Facilitators – Developing and implementing a CMS program can be a long and complex process for companies unfamiliar with such programs. Third-party facilitators, such as WMRC and similar agencies, can serve as facilitators, helping SMEs through the process. The CMS suppliers can work with these agencies to develop their facilitation capabilities.

Conclusions

Small and medium enterprises have a significant need for chemical management services, and offer a significant potential market for CMS providers. However, financial barriers make traditional CMS programs unprofitable in smaller accounts. To overcome these financial barriers, CMS suppliers must enhance their revenues and reduce their costs. This will require significant changes in CMS programs for SMEs. In addition, SMEs experience a number of non-monetary barriers to the adoption of CMS. These barriers must also be reduced if CMS is to be widely adopted. Governmental and non-profit organizations can assist in overcoming barriers to CMS and increasing the rate of adoption among SMEs.

The most important recommendations for increasing adoption of CMS in SMEs are:

1. Aggressively develop new chemical-minimizing technologies.

   CMS suppliers need to aggressively pursue new technologies that can reduce plant chemical usage by 80-90%. In part, this can be accomplished through partnering with research organizations such as WMRC. These technologies should be broadly applicable to a wide array of SMEs with minimal additional research and development. The goal is

to produce dramatic reductions in chemical costs while minimizing research, capital, and operating costs for the technology.

2. Develop and market a broader selection of value-added services as part of the CMS package.

   The chemical use of SMEs is not large enough to make traditional CMS programs profitable. CMS providers must enhance revenues by offering more value-added services that reduce chemical-related costs and "headaches" for the SME. Targeted costs, "headaches" and potential services could include:

   - Waste treatment and disposal costs – including management of waste treatment operations.
   - Equipment and tool life – including purchase and management of tools.
   - EH&S costs and paperwork "headaches" – including management of EH&S services (reporting, MSDS management, training, etc.)
   - Product quality/scrap/rework costs.
   - Clean-up and spill management costs.
   - Energy costs related to chemical management.
   - Process downtime .
   - ISO 14001 certification assistance.
   - Process engineering service.

3. Develop case studies and "demonstration sites" so that SME managers can "observe" successful CMS programs.

   Once a SME manager expresses initial interest in CMS is it necessary to reduce the potential CMS risk to the point that they are willing to develop an RFP and work with prospective suppliers to write viable proposals. This requires overcoming the typical skepticism about the effectiveness of CMS, its compatibility with existing work practices, and the trustworthiness of its suppliers. This is probably best accomplished by allowing managers to "experience" CMS through case studies and demonstrations sites, which require a minimal upfront investment of time and money.

4. Develop technologies and work practices to allow CMS programs to operate successfully with only part-time staff.

   CMS programs in SMEs can be profitable when part-time staff are used. To achieve CMS benefits staff time should focus primarily on process improvement. New technologies and work practices are needed to perform the basic maintenance functions and monitoring activities with a minimum amount of CMS staff time. These could include remote process monitoring, training of plant staff, etc.

5. Third-party organizations should facilitate the solicitation and development of CMS proposals.

   To help SMEs overcome the learning curve with CMS, third-party organizations, such as WMRC, can assist through several facilitating activities. First, they can compile a list of companies, with relevant company information and references, that are interested in

providing CMS services. Second, upon request and funding from an SME, the organization could assist the SME with the development of an RFP to solicit proposals. Third, WMRC can provide CMS consulting services to assist both SMEs and suppliers with the development of CMS programs and serices respectively.

6. Explore innovative pricing strategies for CMS in SMEs.

Current CMS pricing strategies often rely on a fixed fee and the potential to reduce chemical costs through inventory management and process improvements. Successful CMS strategies for SMEs, however, may require pricing strategies that reduce risk for both buyer and supplier. Gainsharing may be one strategy to expand the scope savings opportunities beyond chemical reductions, yet limit both side's financial commitments until additional savings opportunities are identified.

7. Study SMEs to identify the relevant chemical-related needs.

To get the attention of busy SME managers, marketing messages must communicate in the SME managers' language. Interviews, focus groups, or similar methods can be used to acquire and understanding of the chemical-related needs of SME managers and be able to present CMS marketing materials in the language and culture of the SME managers.

8. Conduct third-party outreach to SMEs about CMS.

Third-party organizations can promote the diffusion of CMS by performing critical outreach services. Government organizations, such as state and federal environmental agencies, have a wide array of communication channels available, from conferences to newsletters to compliance agreements. Articles and editorials in periodicals are also a valuable way to reach SMEs and others with information about CMS.

Chapter II

Case Study of a Successful CMS Program in an SME

History

Company A (name withheld upon company's request) produces a product that is housed in an aluminum canister. Canisters are produced in a process called "can drawing," which actually consists of a number of steps. Aluminum discs are initially pressed into the shape of a cup, and then pass through a series of drawing and ironing steps to stretch and form the aluminum into a canister. Lubrication of the aluminum during these steps is essential to assure that neither the product nor the equipment is damaged during processing. Finally, canisters are cleaned and an internal liner is applied.

Both federal regulations and customer expectations require a high level of quality in the final canister. The interior and exterior surfaces of the canister must be free of scratches and any residual lubricating fluid used in the can drawing process. Proper functioning of the can drawing operation is essential to meet final product quality standards and productivity targets.

Prior to the beginning of the CMS contract, a variety of chemicals from various manufacturers were used in the process. A "cupping fluid" was used in the initial step and was applied directly to the aluminum disc before it is cupped. A "drawing fluid" was used in subsequent drawing and ironing steps. Both fluids were mixed from concentrate and water. Spray nozzles were used to apply the drawing fluid to the product during the operation. Cleaner was used in the final step of the can drawing operation to remove the cupping and drawing fluids prior to canister coating.

Can drawing operations were plagued with production "headaches" and subsequent quality problems. Fluids became rancid every four weeks and more frequently in summer. A "dump and fill" strategy was used to address this problem. Foul odor and contact dermatitis were common complaints from the employees. Additives were used to control bacterial growth and prevent the water and concentrate from separating. Changing out the fluid required shutting down production for an entire shift. The waste by-product was legally hazardous. It included spent cupping and drawing fluid, but also hydraulic fluid that leaked from equipment. In addition all of the rinse water used for cleaning out the equipment was deemed hazardous. Though the annual spend on cupping and drawing fluid was under $50,000, the plant was spending approximately the same amount of money on waste haulage.

In addition, quality was difficult to maintain for the engineering staff. As fluid became rancid, scratches appeared on canisters. When larger canisters were made, fluid concentration had to be increased to keep the aluminum from binding to the equipment. In turn, the washing step had to be extended to remove the additional fluid, producing wastewater with higher levels of fats, oils, and grease (FOG). Both product quality and productivity were significantly affected by the chemical problems.

The CMS Contract

Mike P., operations manager at the plant, knew that there had to be a better way. He was convinced that if the canister production process could be organized as an integrated unit, the process could be dramatically improved, reducing waste, downtime, odor and dermatitis. This would result in improved product quality and productivity. Hugh M., of Fuchs Chemical submitted a CMS proposal that changed the process and substantiated Mike P's belief.

Fuchs was the plant's supplier of drawing fluid. Though Fuchs had CMS operations at other facilities, their CMS program targeted plants with at a minimum one million dollar chemical purchase. Fuchs had never implemented a CMS program at a plant with a chemical purchase of less than a one million dollars, much less a program that was under $50,000. But, as a chemical engineer, Hugh believed a CMS program could be profitable if improved chemical technology and management practices produced dramatic improvements in product quality for the plant. He proposed a radical idea: the plant would pay Fuchs a fixed monthly fee equal to the previous chemical purchase plus a significant percentage of the current waste fluid haulage cost. In return, Fuchs would supply the fluids and apply it's expertise in chemical technology to improve the canister production process. In addition, Fuchs engineers would visit the plant at least once a week to manage inventory and monitor the process fluids. Mike agreed and a bold experiment was begun.

As Mike explained, it was a logical thing for his plant to do:

> "We no longer pay for fluid volume; we pay for performance – which is what we really want. As a customer in a fixed fee relationship, we could have sat back and become complacent, but we didn't. We stayed involved – 'why don't we try this, what about that.' We always push for improvement."

Hugh explained that the agreement was simple and straightforward:

> "We tried to keep it simple. The contract is basically a letter and a handshake. We understand that if there is a problem with the process, we are both in trouble. It is in our [Fuch's] best interest to keep everything running and running well."

The new program was implemented and put to the test.

Overcoming Problems

Initially, the plant and Fuchs did not change the process chemistry – they used all the same chemicals from the same suppliers. Instead, Fuchs tried a fluid recycling technology in an attempt to clean the fluids on site to extend their production life. But problems surfaced quickly. As Mike explains:

> "We'd shut down for a shift to recycle, but as soon as we'd start up, we were drawing terrible. Hugh and I would be in here in the middle of the night trying to figure out what went wrong. Instead of recycling, we had to actually add more fluid just to keep the process running. By the third time, I nearly blew a gasket. What was missing? What were we taking out of the fluid in the recycling process?"

Hugh began to recognize the complexity of the problem:

> "We had six suppliers providing six different chemicals to the canister production process. No one had looked at compatibility issues. No one had carefully looked at improving and controlling the process. We realized we had to rethink the entire chemistry and take a thorough look at the entire process. Mike agreed."

When asked why the plant continued with CMS, despite the failure of recycling, Mike responded,

> "I didn't want to go back to dumping this stuff in the waste stream. I respected Hugh for his knowledge of chemicals and his dedication. Every time there was a problem, he would come in. It could have easily broken off, but there was dedication on both sides to make it work. I knew there had to be a better way."

Success

When Hugh and a team of Fuch's researchers examined the process they found incompatibilities in the chemistry, particularly between the cupping and drawing fluids. Cupping fluid that was carried over to the drawing process was fouling the drawing fluid. Fuchs was able to engineer a drawing fluid specifically for the process. One component of the drawing fluid was used in the cupping operation, solving the carry-over problem.

Hugh explained that this would never have been possible under a standard chemical supply contract:

> "The new fluid is far more expensive than the old fluid and far more expensive than anything our competitors sell. If we had to sell it on it's price, no one would buy it. But under the CMS contract, Fuchs pays for it. It's worth the cost because it saves Fuchs and the plant money in many other ways."

Fuch's and the plant personnel also made improvements in the equipment. Leaking hydraulic fluid had caused many of the drawing problems. The team tracked down the source of the leaks and more rigid maintenance procedures were implemented to correct them. Fluid spray nozzles were also replaced. Over time, the nozzles had clogged and never worked properly. The new nozzles applied fluid directly to critical areas of the canisters in appropriate quantities.

These and other changes had a profound effect on process performance. Fluid life was extended six-fold, so fluid is now changed-out only twice per year. Even though the plant doubled the number of drawing machines during this period, the amount of fluid required and the amount of

waste generated was cut by 80%. Because the re-engineered fluid lasted longer and fluid change-outs were reduced the production process no longer had to be shut down every four weeks for change-outs. The improved fluid quality resulted in the highest product quality and the lowest die re-tooling rates that the plant had experienced. Odors and dermatitis were eliminated. Additional chemical additives were eliminated as well.

Table 2-1: Process improvements and resulting benefits from the CMS program.

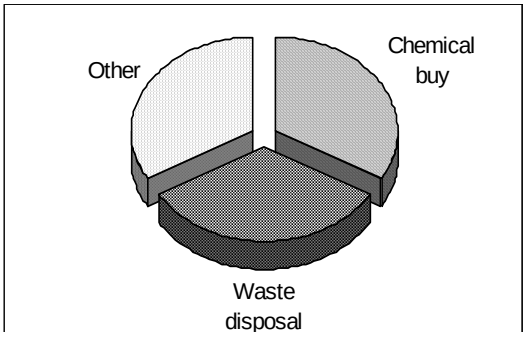
Improvements	Benefits
• Developed custom drawing fluid. • Made cupping and drawing fluids compatible. • Fixed hydraulic fluid leaks. • Improved spray nozzles. • Improved employee training and system maintenance.	• Waste haulage reduced 80% • Process shut-down for fluid change out cut from 13 to 2-times per year. • Odors eliminated. • Dermatitis eliminated. • Product quality at all-time high. • Die re-tooling rates at all-time low.

Financial Analysis of CMS Program

This CMS program is profitable for both Fuchs and the plant because both have agreed to include costs beyond the purchase price of chemicals in their financial relationship. The plant pays a CMS management fee which is significantly higher than the previous chemical purchase. This makes financial sense because the Fuch's CMS program has cut other chemical costs dramatically. Most significant are waste haulage costs, which have been cut by 80%. However, the other costs, such as scrap and die re-tooling, as well as process down-time, have also been significantly reduced.

Figure 2-1 illustrates the approximate total cost of chemicals prior to CMS. The costs included not only of the chemical purchase, but also waste disposal and other production costs, including scrap and die re-tooling. Plant management recognized that paying a CMS fee in excess of the chemical purchase would be profitable if the "hidden" costs could be identified and reduced by an even greater amount. This is illustrated in Figure 2-2, where the savings resulted from dramatic reductions in waste and other production costs, even though the CMS fee exceeds the prior chemical purchase.

Figure 2-1. The total cost of chemicals prior to CMS. The size of each pie slice does not necessarily reflect the exact size of each cost component.



For Fuchs, this account is profitable because Fuchs was able to increase its revenue as well as reduce chemical related costs. Costs for Fuchs include the significantly more expensive coolant, though the volume of coolant was reduced by 80%. They generated significant labor savings by utilizing Fuch's engineers to research the problem and its resolution, as well as weekly visits to

the plant. These costs exceeded the prior chemical purchase; the account would not be profitable without the additional revenue from the CMS fee.

Conclusions

This case illustrates how a CMS supplier implemented a profitable CMS account in a small facility . Two factors were instrumental to the financial success of this program. First, the CMS fee was *significantly* in excess of the previous chemical purchase for the plant (under $50,000/year). Second, the supplier was able to implement new chemical technologies and process improvements that dramatically reduced chemical usage as well as other chemical-related costs.

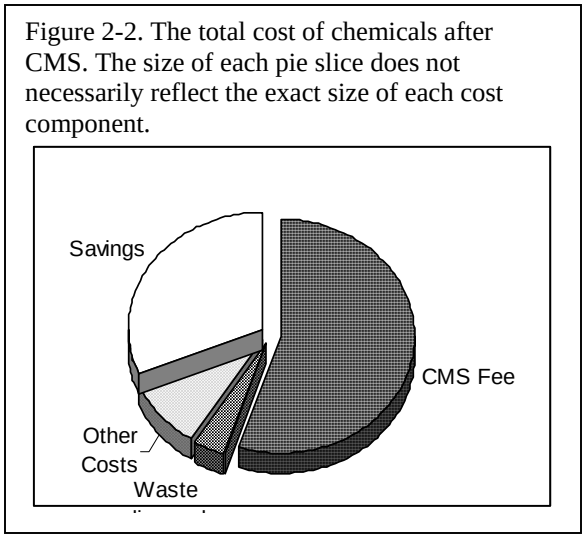


Figure 2-2. The total cost of chemicals after CMS. The size of each pie slice does not necessarily reflect the exact size of each cost component.

The program succeeded despite initial difficulties with controlling process chemistry, a problem that required significant time and effort from both plant and supplier. However, once the initial problems were resolved, the supplier was able to limit personnel costs by making weekly visits to the plant, instead of a full-time manager.

The program was profitable for the plant because reduction of the total chemical-related costs, including such costs as waste disposal, scrap, die re-tooling, and process down-time, more than offset the difference between the old chemical buy and the new CMS fee.

Part 2:

A CMS "Standard"

Chapter III

Structuring a CMS "Standard"

The Need for a CMS "Standard"

As discussed in Chapter 1, Chemical Management Services (CMS) is an innovative approach to chemical supply that reduces both chemical waste and chemical cost – it is good for the environment and good for business. Since its inception in the mid-1980's, CMS has been implemented in nearly every manufacturing and assembly plant of the major U.S. automakers. Nevertheless, growth of CMS outside of the auto industry has been slow, even though the auto sector represents only about 5%-10% of CMS's potential market (Bierma and Waterstraat, 2001, CMS Forum 2000).

Our previous research found that one significant factor limiting diffusion of CMS is buyer confusion about the structure of a CMS program and how it differs from traditional purchasing programs such as supplier consolidation, leverage buying, strategic sourcing, electronic commerce, and other programs (Bierma and Waterstraat, 2001). CMS is a very different approach to materials supply, and can initially appear complex until its fundamental characteristics are understood. In addition, it contains elements of many other purchasing initiatives such as strategic sourcing and electronic commerce. Thus, it is easily confused with other material supply programs that are marketed as "chemical management" even though they do not offer the financial and environmental benefits of CMS.

In business terms, this is a problem of *product differentiation* - the ability of the customer to readily differentiate the desired product from other *inferior substitute* products. Lack of product differentiation limits CMS diffusion because competing (inferior) products or ideas are adopted by many buyers believing they are implementing CMS. In addition the absence of product differentiation, allows suppliers of inferior CMS substitutes to enter the CMS market easily; that is, there are no *barriers to entry*. Any supplier can call their chemical program CMS. A chemical buyer with limited knowledge and experience cannot easily differentiate between this program and a "true" CMS program.

The problems of *product differentiation* and *barriers to entry* result from buyer uncertainty about the service. This is a common problem faced by suppliers of many products and services. One approach to reducing buyer uncertainty that has been used successfully in other industries is a *standard*. In the following sections, we discuss the use of standards for reducing buyer uncertainty, explore the underlying structure of standards, and recommend a limited number of options for a CMS standard.

Standards and Buyer Uncertainty

Standards have been widely applied by business and government as a means of reducing buyer uncertainty. Table 3-1 highlights a few of the standards that are used as examples in this chapter. All provide some measure of economic benefit by reducing buyer uncertainty. For example, accreditation of educational institutions reduces uncertainty about the educational quality of an academic institution for students and parents; financial accounting standards reduce uncertainty about the quality of financial information for investors; the "UL Listed" tag on electrical products reduces consumer uncertainty regarding the safety of an electrical product; and ISO

9000 certification reduces uncertainty about quality for industrial product purchasers. Each standard reduces the buyer's concern about product quality and differentiates the product from inferior substitutes, thereby raising the barriers to entry for companies that would produce inferior substitutes. Reducing uncertainty and limiting inferior substitutes are two valuable attributes of well-written standards.

The American Heritage Dictionary defines the word *standard* as:

> *An acknowledged measure of comparison for quantitative or qualitative value.* (American Heritage Dictionary, 2000).

This definition is appropriate for our purposes for several reasons. First, it is a broad definition, including far more than just regulatory standards. Second, the term *acknowledged* indicates that a standard is more than an individual customer preference, but rather an expectation that is shared by a group of customers. Third, a standard is a *measure of comparison* that allows a company to compare its processes, its products or its service to its competitors. Finally, to be successful, standards must address something that is *valued* by customers.

The Structure of Standards

As the definition of *standard* suggests, one standard can differ markedly from another. To design a standard for CMS, it is necessary to understand the basic structure that underlies all standards, relate that structure to the intent of the standard, and then apply that understanding to structure an appropriate CMS standard. In this section, we explore the underlying structure of standards and how they are related to the standard's intent. We use a number of existing standards to illustrate this underlying structure (see Table 3-1).

We use the following five dimensions to define the underlying structure of all standards:

1. **Intended Customers** – What individuals are the primary and direct beneficiaries of the standard? Stated another way, whose uncertainty will be reduced as a result of this standard?

2. **Product/Process/Producer** (Focus) – Does the standard apply to the product itself, the process by which it is made, or the organization that produces it? In some cases, a standard may apply to more than one. This is also referred to as the standard's *focus*.

3. **Mandate** – Is compliance with a standard required, voluntary, or something in-between?

4. **Authoring Body** – What organization authored and maintains the standard? What is this organization's level of credibility?

5. **Verifying Body** – What organization is responsible for assuring that the product, process, or producer complies with the standard, and what is their level of credibility?

Each of these dimensions is discussed below.

Table 3-1. Examples illustrating the five dimensions for structuring standards.

Standard	Customer	Focus	Mandate	Authoring Body	Verifying Body	Resource
Color Definition	Printer Manufactures and Customers	Product	Voluntary	General Requirements for Applications in Commercial Offset Lithography (GRACol)	Customer	Leyda, 2000
Current Procedural Terminology (CPT)	Medicare and other medical insurance companies	Process	Monopolistic	American Medical Association (AMA)	Producer	AMA 2003
Environmental Technology Verification	Technology customers and government environmental permitting staff	Product	Voluntary	USEPA, Producer	Third party testers	USEPA 2003
Financial Accounting Standards – Generally Accepted Accounting Principles (GAAP)	Investors and users of company financial data	Process	Monopolistic or mandatory, depending on market	Financial Standards Accounting Board (FSAB)	Third-party auditors	FASB 2003 SEC 2003
Fluorescent Lamp Ballasts	Lamp purchasers	Product	Voluntary	American National Standards Institute (ANSI) and other authoring bodies (i.e. Underwriters Laboratories, Inc.)	Underwriters Laboratories, Inc.	UL 2003
Food Service Equipment	Food service patrons	Product	Monopolistic or mandatory, depending on market	NSF International and the American National Standards Institute	NSF International	NSF 2003
Accreditation of Healthcare Organizations	Medicare and other medical insurance organizations	Producer	Monopolistic	Joint Commission on the Accreditation of Healthcare Organizations (JACHO)	JACHO surveyors	JACHO 2003
ISO 9000	Generally manufacturers, and other purchasing products and services	Process and producer	Mandatory, monopolistic or voluntary, depending on market	International Organization for Standardization (ISO)	Third-party auditors, producers	ISO 2003

Table 3-1. (continued)

"Low Fat" Food Label	Consumers	Product	Volunataryy	US Food and Drug Administration (FDA)	Producer	FDA 2003
ISO 14000	Generally manufacturers, and others purchasing products and services	Process and producer	Monopolistic or voluntary depending on market	International Organization for Standardization (ISO)	Third-party auditors, producers	ISO 2003
Organic Food Label	Consumers	Product	Voluntary	US Department of Agriculture (USDA Administration	Third-party auditors, producers	USDA 2003
School Accreditation	Students and funding organizations and personnel	Process/producer	Voluntary	North Central Association Commission on Accreditation and School Improvement (NCA CASI)	NCA CASI reviewers	www.ncacasi.org
Tensile Strength of Steel Wire	Wire customers	Product	Voluntary	American National Standards Institute (ANSI)	Third-party auditors, producers	ANSI 2003
Wireless Communication	Producers	Product	Voluntary	Institute of Electrical and Electronics Engineers (IEEE)	Producers	IEEE 2003

Color Definition Standard – Two printing industry organizations – the General Requirements for Applications in Commercial Offset Lithography (GRACoL), and Specifications for Web Offset Printing (SWOP) – create color standards and means by which those standards can be reproduced in the printing process (GAM 2001, GRACoL 2003, Leyda 2001). The purposes of the standards include allowing an "open color exchange" as well as providing an "anchor" that printers can use to adjust their printing equipment settings in order to achieve consistent and accurate color reproduction (Leyda 2001).

Current Procedural Terminology (CPT) - CPT is a listing of descriptive terms and codes for reporting medical services provided and procedures performed. The purpose of CPT is to provide a uniform language that accurately describes medical, surgical, and diagnostic services, and thereby serves as an effective means for reliable nationwide communication between physicians, patients, and third parties payers (insurance companies, etc.). Medicare and insurance companies require that healthcare providers use this coding system to reimburse physicians and outpatient medical procedures (AMA 2003), therefore it has a monopolistic mandate.

Environmental Technology Verification (ETV) – To increase the rate at which new environmental technologies are developed and adopted, USEPA created a system for verifying producer's claims about each technology (USEPA 2003). USEPA oversees development of testing protocols, but most testing is done by independent testing organizations. The process provides verification status for individual products rather than classes of products.

Financial Accounting Standards – Generally Accepted Accounting Practices (GAAP) - Generally Accepted Accounting Principles (GAAP) apply to business enterprises and regulate how financial information is maintained and reported to those outside the company. The Financial Accounting Standards Board (FASB) oversees the authoring process, though many accounting organizations are involved (FASB 2003). For publicly traded companies, the Securities and Exchange Commission (SEC) mandates compliance with GAAP (SEC 2003).

Table 3-1. (continued)

Fluorescent Lamp Ballasts – Underwriters Laboratories, Inc. (UL) verifies that consumer products meet relevant standards for safety, quality, or other characteristics (UL 2003). These standards may be authored by UL but may also be authored by other ANSI-member organizations or other appropriate standard-setting body. One example is standards for the safe design and function of ballasts for fluorescent lamps. For lamp producers who seek UL listing, UL tests and certifies that that the ballasts meet applicable ANSI standards. For many products, UL not only tests and certifies the products, but also performs follow-up inspections of the production process to assure that the product continues to be made as tested.

Food Service Equipment –Equipment used in the commercial preparation of food must be easily cleaned and sanitized. Standards for this are generated by both the American National Standards Institute (ANSI) and NSF International (NSF 2003). Equipment is tested and certified by NSF International. Though the certification process is voluntary, many local governments require NSF certified equipment (or recognized equivalent) in food service facilities.

Healthcare Organization Accreditation – The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) develops standards for the proper operation of hospitals and other health care providers (JCAHO 2003). The standards detail important functions relating to care of individuals and the management of health care organizations, framed as performance objectives. JCAHO accreditation is voluntary, but participation in the program insures that the healthcare facility is eligible for Medicare reimbursement. Most private insurance organizations follow Medicare's lead in using JCAHO accreditation as a criterion for reimbursement.

ISO 9000 – The International Organization for Standardization, long a source of engineering standards, created a series of "generic" standards on how organizations should operate in order to produce and improve the quality of whatever they produce (ISO 2003). The standards, commonly referred to as ISO 9000, do not specify quality attributes of the product or service, but rather how the production process is managed. Most organizations use a third-party auditor to verify compliance with the standard and award certification to the organization. However, the standards also allow for "self-declaration" of compliance. Though technically a voluntary standard, its extensive use throughout the European Union and other nations clearly monopolizes certain markets. In some cases, certification is mandatory for import.

ISO 14000 – Similar to ISO 9000, above, ISO 14000 is a series of "generic" standards on how organizations should operate in order to identify and reduce the environmental impact of their operations (ISO 2003). The standards, commonly referred to as ISO 14000, do not specify environmental standards, but rather how the environmental impacts of the production process should be managed. Most organizations use a third-party auditor to verify compliance with the standard and award certification to the organization. However, the standards also allow for "self-declaration" of compliance. Though technically a voluntary standard, some companies require all suppliers to be ISO 14000 certified. Thus, the standard monopolizes certain markets.

"Low Fat" Food Label – The Food and Drug Administration (FDA) governs a number of claims that can be made on food packaging, such as "low fat," "low sodium," or "low-calorie" (FDA 2003). This covers all aspects of production from the soil to the processing plants. Third-party certifiers evaluate the production process and authorize the use of the "USDA Organic" label on the product. Labels such as "low fat" are voluntary in that food producers can choose whether or not to use them. However, once a producer chooses to use a label, it must meet the requirements of the standard.

Organic Food Label – US Department of Agriculture (USDA) rules currently being phased in will require all foods labeled as "organic" to meet USDA organic production guidelines (USDA 2003). This covers all aspects of production from the soil to the processing plants. Third-party certifiers evaluate the production process and authorize the use of the "USDA Organic" label on the product. As with "low fat" labels, the standard is voluntary in that food producers can choose whether or not to use it. However, once a producer chooses to use the label, it must meet the requirements of the standard.

Table 3-1. (continued)

School Accreditation – North Central Association Commission on Accreditation and School Improvement (NCA CASI) provides standards for design and management of educational programs (NCACASI 2003). Accreditation is available for elementary, middle, secondary, college preparatory, vocational/adult, special purpose, and unit (K-12) schools. Similar to ISO 9000 standards, NCA CASI standards focus on managing and improving the educational process, though it is the producer (the school) that receives accreditation. Though voluntary, NCA CASI accreditation is widespread and approaches "monopoly" status in some educational markets.

Tensile Strength of Steel Wire – The American National Standards Institute (ANSI) works with about 200 public and private organizations to develop national consensus standards (ANSI 2003). Standards developed by these organizations in accordance with ANSI protocols are considered ANSI standards. One example is for the characteristics of high tensile strength, cold drawn steel wire. This standard, developed by an ANSI-member organization (the American Society for Testing and Materials), and designated ASTM A679/A679M-00, is voluntary for producers of such wire. Compliance with the standard is evaluated by third-party evaluators or by the producers themselves, but must be done in conformance with ANSI testing methods.

Wireless Communication – IEEE 802.11b™ is the most widely used wireless local area network (WLAN) technology. The standard was ratified by the Standards Board of the Institute of Electrical and Electronics Engineers (IEEE). The IEEE Standards Association (IEEE-SA) is a membership organization that produces international standards. Communication device manufacturers use these standards to manufacture devices that will work with devices from other manufacturers. The application of the standard is critical to a wireless company's success in the wireless marketplace, since sales of a new wireless device is based on its ability to work with other wireless devices.

Intended Customer

All standards have customers. These are individuals or organizations whose uncertainty will be reduced as a result of the standard. For some standards, the customer is obvious. For food labels such as “low fat” or “organic”, the customer is the grocery shopper. For standards governing electrical and fire safety of household appliances, the customer is the appliance consumer.

In other cases, identifying the customer may be more difficult. For standards governing the development of financial statements, the customer is the investor who must trust that the financial statement provides an accurate picture of the company. For standards of compatibility for wireless telecommunications equipment, the customer may be the consumer or business buyer of wireless products. However, it may also be a manufacturer who must buy compatible components for their telecommunications equipment.

Product/Process/Producer (*Focus*)

Standards generally apply to a product (or service), the process by which a product is produced, or the organization that produces it. In some cases, the standard applies to more than one. Below, we discuss three types of standards that apply to products. This is followed by discussion of standards that apply to processes and producers.

Product Performance Standards

Product performance standards reduce the uncertainty for the buyer by assuring that the product meets specific performance claims or characteristics. In some cases the buyer may be knowledgeable of the specific performance characteristics that are required, while in other cases the buyer may be completely unaware of the performance requirements. In either case, product marketing can be enhanced when a standard reduces buyer uncertainty about product characteristics.

For industrial applications, these may be highly technical standards such as tensile strength or corrosion resistance (see Table 3-1). Consumers, on the other hand, may rely upon a certifying body to assure compliance with standards of which they have little knowledge or understanding. Examples include Underwriters Laboratories (UL) certification for electrical appliances such as fluorescent lamps, or NSF International’s sanitary certification for food service equipment (see Table 3-1).

An interesting variation of this approach to performance standards is the US Environmental Protection Agency’s Environmental Technology Verification program (see Table 3-1). The agency promotes third-party verification of the performance of technologies intended to reduce or remove pollutants. The purpose, according to EPA, is to “…accelerate the development and commercialization of improved environmental technology.” This is done by “…verify[ing] the performance characteristics of commercially ready environmental technologies…so that potential purchasers and permitters are provided with independent and credible assessment of technology that they are buying or permitting” (USEPA, 1999).

Product performance standards create value for the buyer by providing important product information that is usually beyond the buyer's ability to assess independently. It allows the buyer to distinguish quality products from otherwise indistinguishable inferior products.

Product Compatibility Standards

The purpose of product compatibility standards is to assure that the product will function properly with one or more other products. These standards dramatically reduce uncertainty for the buyer, though buyers may be completely unaware of the standard. For example, the standard may be something as basic as a fitting for a garden hose that will attach to an outside faucet, or it may be as complex as a wireless connection between a PDA and a notebook computer (See Table 3-1). Compatibility standards are widely used in the electronics and telecommunications industry. This allows consumers to select from a wide variety of information technology and be assured that it will communicate with other equipment.

The lack of compatibility can stifle market growth. Some attribute Apple Computer's loss of market share in the 1980's to its refusal to share its computer technology standards with other information technology developers (Sanford 2003). In contract Microsoft's growth exploded with the early development of DOS and the company's willingness to share its technology requirements with other vendors

Standard Product Definitions

Confusion about the definition of a product is not unique to Chemical Management Services. In many industries uncertainty about product definitions has limited market growth. Standard product definitions clarify the meaning of product terms. Again, this reduces uncertainty for the buyer, facilitating the purchasing process. Product definitions serve to differentiate products that meet the standard definition from those that do not.

Accurately describing and reproducing colors can be difficult in the printing industry. Whether in communications between printers and their customers, printers and their ink suppliers, or among printing staff, uncertainty about the terms used to describe color can lead to poor printing performance and waste. The industry has established a set of color standards and the means to reproduce them in the printing process (see Table 3-1). Printers who do not adhere to these standards or are not able to accurately reproduce them are at a competitive disadvantage. Printing industry customers can verify compliance to the color standards by visually comparing the final product with the industry standards.

Food is a product with a long history of standard definitions. A well-known example is the Food and Drug Administration's (FDA) standardized food terms such as *Low Fat* or *Low Sodium* (see Table 3-1). FDA determines the specific criteria for legally using a food term, yet the producer makes its own determination of whether its product meets those criteria. Similarly, standards for the labeling of "organic" foods have seen considerable activity in recent years (see Table 3-1). The new USDA food label for organic foods is viewed by some

as a likely boost to the industry (GMA, 2002), while others believe it sets the bar too low and will put true organic products at a competitive disadvantage (Cavallaro, 2002).

Standard definitions are common for a wide array of products. In the gear industry, customer uncertainty about obtaining proper gear characteristics led to the founding of the American Gear Manufacturers Association (AGMA) in 1916, an organization that establishes voluntary gear standards for the industry (AGMA 2003). Standard product definitions for gears allow gear buyers to easily specify the type of gear needed, no matter which supplier they purchased from. Similarly, international standard definitions have been created for grades of various materials ranging from paperboard to steel by the Deutsches Institut fur Normung, or DIN (DIN 2003). There are even standard product definitions for types of black tea (ANSI 1986).

Standard product definitions can also be applied to services. Variation in documentation and naming of medical services creates uncertainty for healthcare insurers, who want to avoid paying for the wrong or inappropriate medical service. In response, the American Medical Association created the Current Procedural Terminology (CPT) codes (see Table 3-1). These codes essentially create standard definitions for services so that services meeting those definitions can be accurately coded and reimbursed.

It is interesting to note that standard definitions for some products can be verified by the customer, while others are verified by the producer or a third party. The key difference is whether the average customer has the ability to assess whether the product complies with the standard definition. In the case of color standards, customers can verify compliance since all that is needed is the standard color and good color vision. On the other hand, customers cannot typically verify the compliance of a food item with the “Low Fat” or “Organic” standards.

Process Standards

Some quality standards apply to the process used to make a product (process quality standard), the individual or organization that makes the product (producer quality standard), or a combination of both. Process quality standards assure that a product was made in accordance with certain specifications or standards. This type of standard can reduce uncertainty for the buyer in several ways. First, it may assure the buyer that the product will be of high quality even in the absence of specific product quality standards. Second, it may assure the buyer that variation in product quality will be minimized since process quality control standards are being followed. Third, it may assure the buyer that continuous improvements in product quality can be expected.

Generally acceptable accounting practices (GAAP) specify the process by which a company’s financial statements should be prepared and presented (see Table 3-1). Compliance with GAAP is voluntary for many privately-held companies. However, compliance with GAAP helps create creditability with creditors and investors because it reassures outsiders that a company's financial reports accurately portray its financial position. The need for accurate financial information by outsiders is so great that GAAP has

essentially monopolized financial markets. If a company wishes to obtain financing, they must demonstrate their financial position through GAAP.

Another type of process standard is a *standard of conduct*. Many regulations - including those governing environmental protection and worker health and safety - are standards of conduct. Examples include limits on the discharge of pollutants to waterways, specifications for respirators to be worn by workers in hazardous atmospheres, and procedures for product recalls. However, government agencies are not the only source of standards of conduct. For example, many professional associations govern the conduct of their members though a code of ethics or similar set of standards. Standards of conduct can reduce uncertainty, clarify roles and responsibilities and enhance market growth. For example compliance with environmental and worker protection regulations can reduce uncertainty for many buyers, particularly corporate buyers who are seeking to protect their image. Even standards of ethical conduct for accounting, legal, or medical services can help reduce buyer uncertainty

Producer Standards

Producer standards assure the buyer that the individual or organization producing the product has the knowledge, skills, and resources needed to produce a quality product. Examples include certification of professionals ranging from doctors, nurses, and attorneys, to electricians and plumbers.

In many cases process and producer standards are combined. Perhaps the most well-known example is ISO 9000 (see Table 3-1). Developed by the International Organization for Standardization, ISO 9000 provides standards not only for the production process itself, but also for supporting processes such as quality assurance, training, and management. It also specifies knowledge, skills, and resources that must be committed to the process. Thus, ISO 9000 certification is a certification of the production process, and also of the organization itself. ISO 14000 uses a similar approach to assuring the quality of environmental management processes (see Table 3-1).

Similar standards apply to the service sector. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has standards for the proper operation of hospitals and other health care providers (see Table 3-1). The standards detail important functions relating to care of individuals and the management of health care organizations. JCAHO accreditation is voluntary, but participation in the program insures that the healthcare facility is eligible for Medicare reimbursement. Similarly, the Commission on Accreditation and School Improvement assures that schools meet certain quality characteristics in their educational process (curriculum), their faculty, and their supporting resources (see Table 3-1).

Mandate

Standards can be implemented using a variety of approaches. Some standards are purely *voluntary*, others purely *mandatory*, while still others - which we call *monopolistic standards* - are somewhere in-between. We present an overview of the differing implementation strategies.

Voluntary Standards

Voluntary standards are those for which there is no requirement to comply other than the opportunity for competitive advantage in the marketplace. Examples include UL certification of consumer products such as fluorescent lamps or USEPA's Environmental Technology Verification program (see Table 3-1). Standard product definitions are typically also voluntary. The choice of whether to participate is up to the product manufacturer. Participation will occur only if it is believed to offer competitive advantage. For example, a food producer is not required to use the food labels "low fat" or "organic," but depending upon their market, it could increase their sales. Similarly, printers are not required to use the standard industry color definitions, but it could make it easier for them to attract and retain customers.

Mandatory Standards

Mandatory standards are enforced through the threat of punishment if violated. Any company operating within the regulated scope of business must comply. Many government standards are mandatory, such as environmental health and safety regulations, or the use of GAAP by publicly traded companies. In addition, many professional standards of conduct are mandatory since they are required for legal permission to practice the profession.

Monopolistic Standards

Monopolistic standards are voluntary, but the competitive disadvantage of failing to comply with the standards is so great as to make them essential for business. This occurs when there are few or no viable markets outside of the standard. That is, the viable market is essentially monopolized by the standard.

One example is hospital compliance standards issued by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). JCAHO certification is not mandated by law, but the mandate comes from the federal government and insurers (see Table 3-1). The U.S. government uses JCAHO accreditation as verification of health care service quality and a criterion for Medicare reimbursement. Most insurance companies have followed this lead. GAAP standards are voluntary as well (outside of publicly traded companies), but it is generally understood in business that outside creditors and investors expect a company's financial reports to accurately portray its financial position through the use of GAAP.

Authoring Body

Standards must be credible to be of value. The customer of the standards must believe that the standards accurately reflect what they, the customers, need in order to reduce their uncertainty.

Since, in many cases, the customer does not have personal expertise in the area covered by the standard, the organization authoring the standard must have credibility. For example, customers may trust a product that conforms to standards of the National Fire Protection Association or Underwriters Laboratories, even if they are not familiar with, or cannot understand, the standards

themselves. Many organizations that author standards go to great lengths to seek the input and support of a wide array of interested parties to assure that the final standards have credibility.

Authoring bodies can be almost any organization, including government agencies, producers and customers. Often third parties, such as the American National Standards Institute (ANSI) or NSF International, author standards. The most important criteria in determining an appropriate authoring body is the ultimate credibility of the standard.

Verifying Body

Once a standard has been created, someone must assess and verify that the product, process, or producer conforms to that standard. Some standards employ a third party to verify compliance. Some standards allow the producer or vendor to certify their own compliance. Still others rely upon the customer to verify that the product or service they are purchasing meets all relevant standards. The choice of verifying bodies usually depends upon how difficult it is for the customer, or other interested entity, to verify compliance. The easier it is, the more likely that the customer will be the verifying body. The more difficult it is, the more likely that a third party will be required. The appropriate choice of verifying body is critical to effectively using standards in service marketing. The implications of verifying bodies failing to perform responsibly can be seen in the aftermath of recent business accounting scandals and their impact on the stock market.

Third-Party Verifying Bodies

The use of a *third party* (someone other than the producer or customer) to verify compliance with a standard is common. Public accounting firms certify that GAAP were followed in the compilation of financial statements. Testing laboratories, such as Underwriters Laboratories and NSF International test and certify products ranging from lamps to kitchen equipment (see Table 3-1). The Joint Commission on Accreditation of Healthcare Organizations inspects and certifies a hospital's compliance with their standards using their own accreditation team. ISO 9000 and 14000 employ third-party auditors to verify compliance (see Table 3-1).

Third-party verifying bodies can improve the effectiveness of a standard when the consumers cannot verify compliance themselves, and when a producer's own certification cannot be trusted. This is particularly true when significant damage or expense may result from not complying with the standard – such as with financial statements and food preparation equipment.

Producer as Verifying Body

In some cases, the producer certifies its own compliance with a standard. Examples include FDA food labeling rules as well as conformance to many standards of the American National Standards Institute (ANSI)(see Table 3-1). ANSI oversees the development of thousands of standards. However, it does not certify a product's or producer's compliance with a standard. This is left to the producer, who may state that their product complies with an ANSI standard, but may not claim that their product is "ANSI certified."

Some process and producer standards may also allow the producer to be the verifying body. Good examples are ISO 9000 and 14000, which govern quality management and environmental management practices, respectively. Both allow for "self declaration" that a facility is in conformance with the standards (see Table 3-1).

Customer as Verifying Body

Occasionally, customers possess the knowledge and resources to independently assess a product's compliance with a standard. This is often true, for example, with manufacturers who buy components that must conform to a specific standard. Despite other certifications, if any, the manufacturer will test or "try" the component before purchasing it. As mentioned previously, customers often verify conformance to standard color definitions in printing (see Table 3-1). Using the standard color definitions and good color vision, customers are able to verify that printed products conform to the standard. Thus, in cases where the customer is able to observe or test characteristics of the product that are required by the standard, customers may, themselves, become a verifying body.

Structuring a CMS "Standard"

The goal of a CMS standard is to reduce buyer uncertainty through product differentiation. The standard should allow customers to distinguish true CMS programs from inferior substitutes such as integrated supply or logistics programs. The five basic dimensions of a standard must be considered in designing the standard, within the context of the CMS marketplace. In the following analysis, each dimension is applied to CMS.

Intended Customer

The intended customer is the individual or entity that will be the beneficiary of the standard itself - whose uncertainty will be reduced by implementing the standard. In the case of a CMS standard this is the chemical buyer. Similar to USEPA's Environmental Technology Verification (ETV) program, JCAHO standards for healthcare organizations and GAAP guidelines for the financial analyst, a CMS standard must provide the potential buyer with a basic level of confidence that a CMS program is actually a CMS program and not a CMS program in name only. Therefore the standard should be structured and written in a format that provides the potential CMS user with a clear, accurate and credible method for differentiating a true CMS Program from an inferior substitute.

Product/Process/Producer (Focus)

To achieve product differentiation, the CMS standard could take the form of any one of several different types of standards, including a *product standard*, a *process standard*, or a *producer standard*. That is, a specific CMS program (product) could be certified or defined (as in USEPA's ETV program), the process used to create the CMS program could be standardized (as

in GAAP), or the CMS vendor could be certified (as in JCAHO accreditation). However, for reasons explained below, a *product standard* appears to be the most promising.

It would be difficult to define, much less verify, the process by which a CMS program is created. Different suppliers use different approaches to CMS, and it is unclear which approach may work best. Thus, process standardization would be difficult if not counter-productive. Similarly, it would be difficult to certify a producer (CMS supplier), since producers offer a wide array of chemical services, including many of the "inferior substitutes" against which CMS competes. Thus, certifying the CMS supplier is no guarantee that the service being sold is a true CMS program.

Focusing on a CMS product standard, applicable options appear to be a *product performance standard*, or a *standard product definition*. A *product compatibility standard* is not applicable since the source of customer uncertainty is about the characteristics of CMS. It is not a concern whether the CMS program is compatible with other components or programs.

Product performance standards are inherently difficult to apply in a service industry. A service is created at the time the customer "consumes" it, thus making it difficult to test product performance before it is purchased and implemented. However, a potentially useful model for a product performance standard is USEPA's Environmental Technology Verification program (see Table 3-1). If CMS were considered a type of "technology," its success could be review and verified at an existing plant with a CMS program. As long as a given CMS supplier offered the same basic CMS program to other customers, the ETV certification would be applicable. One drawback to this approach is that the factors governing success in a CMS program are complex, and CMS program are designed to address customer-specific needs. Thus, verification of a particular supplier's existing CMS program would have to contain the caveat that similar programs in other plants may not achieve the same level of effectiveness.

The most promising approach is a CMS standard product definition, similar to standard definitions used for "Low Fat" foods, gears, or colors (see Table 3-1). The fundamental problem with differentiating CMS from other supply programs is the chemical user's lack of knowledge and understanding of CMS. Providing a clear, accurate definition of CMS services would help chemical users clearly distinguish CMS from other chemical supply programs. Unfortunately, as stated above, CMS programs vary from supplier to supplier and customer to customer. Thus, to be effective, a standard CMS definition must identify the essential components of a CMS program that are key to its success and do not vary among programs.

Mandate

Legally mandating CMS is not practical and could possibly be counter-productive. Since research has demonstrated that CMS programs are most successful when there is a buy-in from management and employees, mandated programs are more likely to fail (Bierma and Waterstraat, 2000). However, one approach to mandating programs that may be successful is in compliance agreements. As a part of the agreement to resolve a compliance dispute, companies could agree to implement a CMS program. Since management may be more open to change at the time of an impending compliance issue, CMS is more likely to win management support and commitment.

In most cases, a voluntary standard will be more practical. CMS can provide a company with significant market advantages, including lower costs, greater productive capacity, and fewer EH&S problems. Thus, a CMS standard that effectively reduces customer uncertainty should be successful on a voluntary basis. Ideally, in time, the voluntary standard would become monopolistic – that is, few companies would consider adopting a chemical supply program that does not comply with the standard. A good CMS standard could also encourage major corporations, such as the domestic automakers, to mandate suppliers to adopt CMS, as some corporations have done with ISO 9000 and ISO 14000. This would help strengthen the monopolistic power of the standard.

Authoring Body

A CMS standard should be authored by a credible source. Options include the CMS suppliers, government agencies, third-parties, or customers.

In one respect, the CMS providers would seem to be the most credible source of a CMS standard since they understand CMS better than anyone else. However, the traditionally adversarial relationship between chemical buyers and chemical suppliers may undermine credibility. One of the most common misperceptions among potential CMS customers is to ask their chemical supplier to manage their chemicals is like "asking the fox to guard the hen house." A standard produced by the CMS suppliers may be viewed in this same light. Some CMS providers also offer the inferior substitutes against which CMS competes, and there may be financial incentive for them to create a CMS standard that is not as clear as it could be. Nevertheless, a successful CMS standard will need to involve suppliers in its development in some way.

Perhaps the most promising source of a CMS standard is the CMS customers themselves. Their financial incentives are the same as prospective CMS customers. They are knowledgeable and have experience with CMS. They also are convinced that it works. Large corporations that have already adopted CMS, such as GM, Daimler-Chrysler, Harley Davidson, Delta Airlines, Raytheon, and Seagate may also be viewed as private-sector role models for many other companies. The CMS Forum, to which many of these companies belong, could be an excellent venue for standard development (CMS Forum 2003). In addition these companies may be willing to participate as a "demonstration" site.

Verifying Body

The choice of a credible and practical verifying body poses one of the most significant challenges to a CMS standard. Producer verification (such as in FDA food labeling) is likely to suffer the same credibility problems discussed above, since many prospective CMS customers do not trust their chemical suppliers. Government or third-party verifiers would provide credibility, but the time and resources required to verify each program would create a significant market barrier. A possible exception to this would encompass a program similar to USEPA's Environmental Technology Verification program. If USEPA were able to verify one CMS program from a supplier, and if the fundamentals of the program did not change as CMS program were implemented in other plants, plant-specific verification may not be needed.

The most promising approach to verify compliance with a CMS standard may be customer verification. Generally, customer verification only works when the average customer has the necessary resources and skills to evaluate the product with respect to the standard. This is somewhat unusual, but one example is the color standards developed by the printing industry (see Table 3-1). In that case, given the standard color chart and good color vision, a customer can verify that a printing job meets or does not meet specifications.

CMS may provide a similar situation, depending on the content of the standard. If the CMS standard specifies a number of services or contract conditions, this may be well within the expertise of most companies to verify. Thus, given a clear standard, customer verification promises both an effective and inexpensive approach.

Conclusions

The greatest barrier to diffusion of CMS is customer confusion and uncertainty about how CMS differs from other chemical supply programs. An effective CMS standard is needed to reduce customer confusion and give CMS a competitive advantage over less economically- and environmentally-beneficial programs.

Based upon analysis of the five dimensions of standards, we recommend the following three options, in priority order:

1. **Customer-driven Standard** – The CMS standard would be authored by a group of current CMS customers and verified by prospective CMS customers. It would be a standard product definition, identifying the essential elements of successful CMS programs. The standard would be voluntary, though it could be mandated as part of negotiated consent agreements. This approach offers relatively high standard credibility and relatively low cost.

2. **USEPA Environmental Technology Verification (ETV) Program** – A CMS supplier would submit a specific CMS program to USEPA for verification through the ETV or similar program. Other CMS programs offered by that supplier would be covered by the verification, provided the essential elements of the program did not change. It would be developed in the format of a product performance standard, authored and verified by a government agency. The standard would be voluntary, though it could be mandated as part of negotiated consent agreements. This approach will require more time and resources for the verification process.

3. **Supplier-driven Standard** – The CMS standard would be authored by a group of CMS suppliers and verified by either prospective CMS customers or by third-parties such as WRMC. It would be a standard product definition, identifying the essential elements of successful CMS programs. The standard would be voluntary, though is could be mandated as part of negotiated consent agreements. It would have relatively low costs, but may not have the credibility of a customer-driven standard.

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