

Chemical Management Services

Advantages, Barriers and Opportunities in the Egyptian Market

- Comparative analysis between Egypt, Europe and the US -

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Abstract

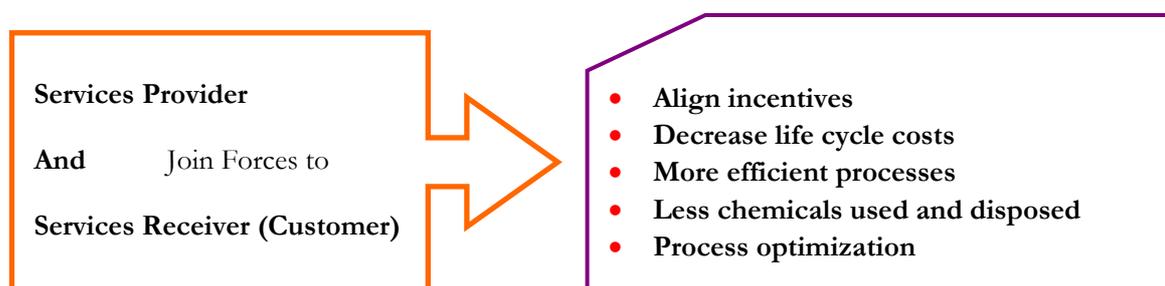
Chemical management services (CMS) is an application of the Product Service System in the chemical sector. It is a new business model based on a long term relationship between customers and service suppliers, who both have the same goal of reducing the costs and volume of chemicals used in the customer's processes. CMS started in the early 1980s in the US and was later transferred to Europe. CMS is not widely implemented in developing countries due to differing social, economical and legal conditions in developed and developing countries.

This thesis is based on a comparative analysis of the benefits and barriers between chemical management services in Egypt and in Europe and the US. It presents the current and future opportunities for implementing CMS in the Egyptian industries. The case of Egypt can be used as an example for a preliminary examination of CMS implementation in other developing countries with similar social, economic and environmental conditions.

Executive Summary

Chemical Management Services is a new business model based on a long term relationship between customers and service providers, who both have the same goal of reducing the costs and volume of chemicals used in the customer's processes. The success of the new model is based on aligning the incentives of both parties and shifting the focus from the amount of chemicals used to the service/outcome they provide.

CMS model creates a 'win-win' business situation between the supplier (service provider) and the buyer (service receiver -customer), by providing financial incentives to reducing the volume of chemicals used and to increasing the process efficiency. The following figure shows the relationship between services providers and customers in the CMS concept.



CMS is currently implemented in several places worldwide, including Scandinavia, Asia, Canada and Mexico. Case studies of successful CMS implementation in Europe and the US are represented in this thesis. The CMS model has been known in the US and Europe for more than a decade, while growth in the model's implementation is expected in several parts of the world.

The chemical industry is one of the major polluters in Egypt. At the same time it numbers as the third largest industry following the furniture and textile industries. New models and initiatives should be adopted to reduce pollution emitted from this industry. CMS is expected to play an important role here, alongside local efforts toward pollution prevention and sustainable development.

Scanning several industries showed that some industrial sectors are using models close to CMS, as for example in textile, petroleum and industrial wastewater treatment producers. Opportunities for implementing CMS in the Egyptian market have also been identified. Promising sectors and processes include: textiles (dyeing and printing), carbonated beverages and breweries (bottle washing and Carbon dioxide (CO₂) production), plastic manufacturing (polymer additives), water treatment (boiler water treatment and industrial wastewater treatment), paints industry (decorative paints), engineering industry (fabricated metals) and the tanning industry (chemical treatment).

Advantages for and barriers against implementing the Chemical Management Services model in the Egyptian market have been identified through investigating and interviewing different local and international CMS providers and customers, several experts and local officials. The following table summarizes the advantages and barriers for implementing CMS in the Egyptian market.

EGYPT	For....	Advantages	Barriers
	Services providers	<ul style="list-style-type: none"> ➤ Improvement of chemicals used ➤ Improved relations with customers ➤ Decreased complaints from customers ➤ Attracting other customers ➤ Improved environmental image ➤ Taking the lead 	<ul style="list-style-type: none"> ➤ “Selling more” mindset ➤ Hard to understand the concept ➤ Absence of financial incentives ➤ Volume and type of chemicals should be suitable ➤ Risk of losing customers ➤ Lack of trust from the customers ➤ Weak competition
	Services customers	<ul style="list-style-type: none"> ➤ Introducing cleaner production and reaching maximum efficiency ➤ Costs saving ➤ Understanding the real cost of chemicals management ➤ Use of fewer suppliers ➤ Outsourcing model ➤ Improved relation with providers ➤ Improved data management and soft-wear usage ➤ Assured quality ➤ Focus on the core business ➤ Transfer to other processes in the factory ➤ Support of authorities 	<ul style="list-style-type: none"> ➤ Hard to understand the concept ➤ Fear of losing control over the processes ➤ Multi-management problems ➤ Limited number of providers ➤ Customers can do it better than providers “sometimes” ➤ Financial problems

A comparative analysis between the advantages and barriers of implementing CMS in Egypt and in Europe and the US, showed both similarities and deviations.

The deviations found in the Egyptian market included immaturity, low research and development (R&D) and low competition between providers.

- *Immaturity of the Egyptian market:* The European and American markets have implemented many successful CMS models. These success stories are like “the initiators in polymerization process”. Implemented cases are the most encouraging aid to industry to apply the new models. Several industrial representatives stated that the Egyptian market is not mature enough to adopt new models and replace current operating procedures with some “new risky models”.
- *Low R&D and low competition between providers:* Low competition in the Egyptian market make it “unnecessary” for providers to develop the business methods employed and use new models like CMS. Customers are not encouraged to start effective research on their product and services, unless external forces (i.e. market, social or environmental) necessitate it. CMS providers have the chance to strengthen relations with customers by developing and innovating ideas or by solving current problems. This can be done through a suitable CMS contract.

Other deviations such as fear of losing customers (fragile and vague relations between providers and customers), financial challenges to implement cleaner production (CP) for customers, weak corporate social responsibilities (CSR) and lower transition costs (comparatively with the US and Europe) are explained in the discussion section of this thesis.

It was found that international, multinational companies and local experienced companies hold responsibilities to raise awareness about CMS and to implement more CMS projects in the local market. Communication channels between national authorities and international organizations supporting CMS should be initiated and developed. Finally, awareness campaigns and workshops for raising knowledge about CMS should be launched and adopted by local parties (local authorities, industrial affiliates, experienced industries) and international parties (international and multinational companies and organization).

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1. Introduction

1.1 Problem statement

Industry in Egypt constitutes around 34% of the national GDP.¹ The National Strategy Plan calls for Egyptian industry to become the leading industrial player in the Middle East and Africa region by the year 2020, and it is thus expected that industrial activities will continue expanding.² According to the Ministry of Trade and Industry, there are approximately 26,450 industrial enterprises, concentrated in Greater Cairo, Alexandria, Delta, Suez Canal governorates and the industrial cities.³ Among many types of industries, the chemical industry in Egypt is one of the most important and oldest industries.

Hundreds of chemicals and chemical complexes are introduced to the market through a complex supply chain, leading to very weak management of the chemicals consumed and used.⁴ Chemical industry can be defined generally as “the business of using chemical reactions to turn raw materials, such as coal, oil, and salt, into a variety of products”.⁵ The history of chemical industry dates back to 7000 B.C. with the production of glass by the Arab artisans. The 19th and 20th centuries saw a rapid growth in the mass production of chemicals around the world.

Since the 1950s major concerns regarding the effects of chemicals on the environment and human health have developed. Several accidents all around the world led to growing support for the need to start searching for the safe management of chemicals. Accidents in Menamata village in Japan and at the Union Carbide Company in Bhopal city, India, provided examples of the extremely damaging effects of the mismanagement of chemical industry, particularly regarding the negative consequences for the environment, economy and human health.⁶

Chemical industry is one of the largest industries in the Egyptian market. There are about 962 large, medium and small enterprises scattered mainly in Cairo, Alexandrian, Suez Canal, delta cities, in addition to the industrial cities. Chemical industry is one of the main sources of pollution in the local environment. Emissions to air, water, solid and hazardous wastes are the main environmental issues causing damage. According to an estimate by the industrial unit in the Egyptian Environmental Affairs Agency (EEAA), chemical industries release large amounts of pollutants into the environment. The following table shows the estimated emissions from the chemical industries in Egypt.

¹ Industrial unit in the Egyptian Environmental Affairs Agency. (2004). *Statuses of Environment in Egypt report*. May 2004

² Green paper for industrial policy in Egypt. (2003). Publication of Industrial Modernization Center. November 2003

³ Egyptian General Organization for Industrialization (GOFI) database. July 2005

⁴ McKinnon, A. (2004). *Supply Chain Excellence in European Chemical Industry*. Result of the EPCA-Cefic Supply Chain Excellence Think Tank Sessions, EPCA & CEFIC: 40pp.

⁵ Bitpipe IT information web page. (2006). Available online at: <http://www.bitpipe.com/tlist/Chemical-Industry.html>, May 2006

⁶ Angie Littlefield, *TED Case Studies*, Case number: 46. available online at: <http://www.american.edu/TED/MINAMATA.HTM>, May 2006

Table 1-1 Estimated Emission from chemical industries.

Emissions	CO Carbon monoxide	CO ₂ Carbon Dioxide	NO ₂ Nitrogen Dioxide	VOC Volatile Organic Compounds	BOD ₅ Biological Organic Demand	Inhaled Particulate
Amount T/y	121 065	112 361	84 992	73 633	13 767	17 705

Source: Industrial Unit EEAA 2005.

Public chemical companies are supervised by the government through the Chemical Holding Company (CHC), which is responsible for outlining the strategies for different public chemical industries such as fertilizers, sodium carbonate, salts and minerals and paints industries. Private companies follow the investment law and most of them are registered in the Egyptian Federation of Industries (EFI).

Chemicals are used in almost all of the industries in Egypt. The main users of chemicals are the public and private companies within the petroleum, fertilizers, textile, pharmaceutical, painting and food industries.

A new national strategy for the management of hazardous material including different chemicals is under preparation now in the EEAA. Unfortunately, the pressures on mass production to increase income and improve the economic situation leads to the excessive use of chemicals in different industries, which then causes a lot of environmental problems during the life cycle of chemicals. "Curbing the environmental impact caused by consumption through technological solution only found to be insufficient. Solutions based on material substitution, pollution prevention and end of life management practices should be combined with reduction of consumption levels".⁷

One approach that is based upon improvements to both the production and consumption sides is called product service systems. One application of the PSS concept for the chemicals sector is called CMS – chemical management services. Both of these strategies will be elaborated below.

As consumers, we are always looking for the product that will satisfy our needs and provide us with the utilities we desire. So our main purpose of buying a product is not buying it *per se*, but demanding the service it provides. Products are not usually sold on their own, rather a product system is sold, potentially including product insurance, maintenance, spare parts, provision of recycling and/or replacement services, which all together leads to satisfying the customers needs competitively and with lower environmental impacts over the life cycle of the product.⁸

Product Service System as a tool to use the life cycle thinking is an approach to sustainable consumption and production adopted by the United Nation Environmental Program (UNEP). As a new business concept, PSS may increase the performance of a business and decrease environmental and social impacts.

⁷ Mont Oksana, Andrius Plepys. (March 2005). *Sustainable Consumption – Research and Policies*. Report 5460. Swedish Environmental Protection Agency.

⁸ Chemical Strategies Partnership web page (www.chemicalstrategies.org/). May 2006

Product Service System (PSS) is defined as “a system of products, services, networks of actors and supporting infrastructure that continuously strives to be competitive, satisfy customer needs and have a lower environmental impact than traditional business models.”⁹

PSS is considered a step beyond such concepts as pollution prevention, cleaner production and re-designing of products. The new approach directs the producers to shift from the traditional “business as usual”, based on selling the product, to a new horizon of selling utility. The result of selling a mixture of products and services reinforces the financial status of the producers and provides more benefits to the consumers. In sum, better financial, environmental and social results can be expected.

Services providing added value to the product life cycle, services providing “final results” for customers and services providing “enabling platforms” for customers are the three promising approaches towards a successful PSS strategy.¹⁰ Chemical Management Service, car sharing, washing service, and carpet leasing are examples of the PSS strategy. This thesis will focus on Chemical Management Services as a promising scheme in the Egyptian chemicals market.

Chemical management services are expanding in the US and Europe. For example, Raytheon Company for high-tech electronics signed a contract with a separate company to deal with the chemicals in the company branches. The results of this new kind of partnership are the reduction of volatile organic compounds (VOCs) to almost nil, a 71% reduction of paint waste and the reduction of operating costs leading to a USD 400,000 saving annually. Other benefits include the reduction of liabilities and the amount of chemicals used by improved chemical management, namely, proper monitoring, handling, reporting, training, and storing of chemicals.¹¹

Chemical management services (CMS) is an application of the Product Service System in the chemical sector. Thomas Votta, deputy director of Chemical Strategies Partnership (CMP) association, considers CMS to be a strong strategic and long-term relationship between the customers (industrial enterprises that receive services) and providers (that supply services), in which the service provider manages the chemical and related services associated with it instead of the customer. CMS helps to optimize processes and to continuously reduce chemical lifecycle costs, risk, and environmental impact, because often chemical service providers are more efficient and can achieve lower production costs than the customers.¹²

“CMS is a proven strategy for cutting total chemical costs, use, and pollution in manufacturing” claims Jill Kauffman, CMP Executive Director. The results of implementing CMS are less chemicals used, less costs, and less pollution. CMP reported that businesses spent USD **1.22 billion** on CMS in 2003, with a growth of more than 122 times the 1999 level, and estimations show that the market has the potential to grow to between USD 17 billion and USD 19.5 billion.¹³

⁹ Mont Oksana. (2004), *Product Service Systems: Panacea or Myth*, Doctoral dissertation. HIEE Lund University. Available on line at: [http://www.iiee.lu.se/Publication.nsf/\\$webAll/D375F6813A2C460CC1256EF9002D15C0/\\$FILE/mont.pdf](http://www.iiee.lu.se/Publication.nsf/$webAll/D375F6813A2C460CC1256EF9002D15C0/$FILE/mont.pdf) . May 2006.

¹⁰ UNEP publication. (2002). *Product Service System and Sustainability: Opportunities for sustainable solution*. Available online at: <http://www.uneptie.org/pc/sustain/reports/pss/pss-imp-7.pdf> . May 2006.

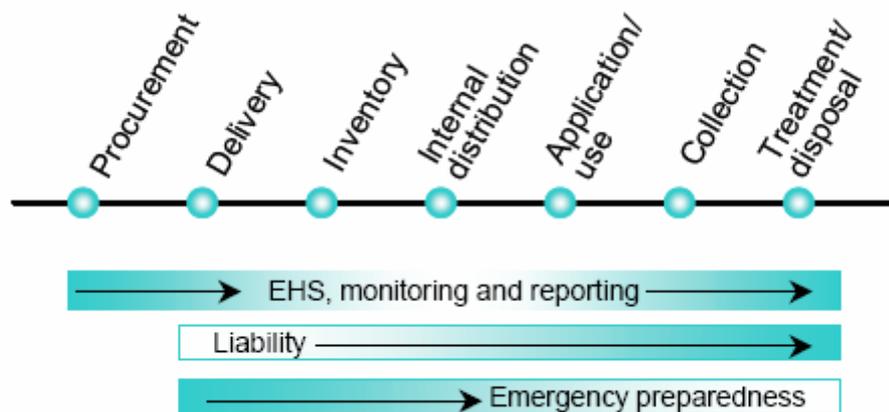
¹¹ Votta, Thomas J. (2001). *Transitioning from Product to Service-Based Chemical Procurement*. 2001

¹² Votta, Thomas. (2005). *CMS presentation on the Privatization Industry Day*, Defense Logistics Agency, Defense Supply Center, Richmond VA. December 2005

¹³ Jill Kauffman Johnson. (2006). Executive Director, Chemical Strategies Partnership, CSP web page (www.chemicalstrategies.org/). May 2006

Service providers manage chemicals from the procurement till waste stages passing on purchasing, inventory, processing and efficiency improvements. In the procurement stage CMS providers can ease selection of chemicals suitable for customers. Through implementing CMS, chemicals become fewer, cheaper and more environmentally friendly than before. The delivery of chemicals to customers is an important step. Liabilities arise because of transportation accidents, and strict precautions make the delivery step very hard without a tight and well managed system. CMS providers can have excellent management during delivery and transportation. When chemicals arrive to the industrial enterprises, the storing and handling of chemicals are critical for the manufacturing step. An organized system of storage, distribution, movement, handling and application using in processes is the key for successful production. CMS provides a useful solution for easy and effective storage, distribution, movement, handling and possessing. Finally, CMS offers options for a safe and proficient collection and disposal of chemicals. Figure 1.1 shows the chemical management life cycle where CMS can be implemented.

Figure 1-1 The Chemicals Management Life Cycle



Source: “Exploring Whether Chemical Management Services are a Potential Mechanism to Facilitate the Reduction, Reuse, and Recycling of Chemicals in Educational Facilities.”(Chemical Strategies Partnership Final Report. January 2004)

There are many problems associated with chemical management in Egypt. Unfortunately, there are only very few initiatives to improve chemical management in the Egyptian industries - such as the “Chemical Leasing program” in cooperation with United Nations Industrial Development Organization (UNIDO), and various programs to raise awareness of hazardous material prepared by the Egyptian Environmental Affairs Agency. The outcomes of these programs are not clear. This report would like to contribute to understanding the factors that affect dissemination of the successful models for chemical management in the US and Europe, particularly the Chemical Management Services model in Egypt.

1.2 Research Objectives

The objectives of this thesis are to investigate existing examples of Chemical Management Services in Egyptian industrial enterprises and to identify opportunities and barriers to further provision and adoption of CMS.

Research questions

The main question that will need to be answered is as follows:

1. What are the present and future opportunities for the introduction of the Chemical Management Service model in different Egyptian industry sectors?

From this question two sub-questions then arise:

- What are the benefits and barriers for implementing CMS model in Egypt? And what are the deviations in benefits and barriers between the Egyptian and European & American markets?

1.3 Research methodology and design

The research will be qualitative, based on primary data collected in telephone and personal interviews and on secondary data from literature analysis, personal experience and internet sources.

Literature related to CMS will be one of the author's main focuses. In addition to that, a revision of existing similar national and international schemes will take place. Further analysis of the findings will be undertaken in order to present a comparative analysis of benefits and barriers for implementing CMS in Egypt, Europe and the US.

The design of the research is divided into three main phases:

- Preliminary phase
- Data gathering phase
- Analysis phase

The goals, sources, methods, expected outcomes and time framework of the three phases are explained in the following Thesis Design Matrix (TDM).

Table 1-2 Thesis Design Matrix (TDM)

Phase	Overall goal	Sources of data	Method used	Expected Outputs
Preliminary review	Identify CMS related studies	Literature, official meetings (9) and industrial experts (2)	Readings, interviews, experts	Review CMS field, international example
Data gathering	Identify existing CMS	Experts(3), industries and literature	Field visits (17), interviews (9), experts and national literature	CMS existing, and identification of advantages and barriers
Analysis	Analyse the advantages and barriers to implementing CMS in Egyptian market	Data gathering findings, literature and experts	Analytical techniques	Advantages, barriers and opportunities of implementing CMS in Egyptian industries

Interviews with different stakeholders will take place as explained in Appendix (1). Companies' interviews with and details of visits are presented in appendix (2).

1.4 Scope and limitations

The research boundaries are limited to local enterprises in Egypt and the study is limited to identifying the advantages, opportunities and barriers to adopting and implementing CMS in the local market. A comparative analysis between CMS in Europe and the US will take place. Large chemical producers and consumers industries from both private and public sectors are investigated. Some company representatives requested that their names not be mentioned in the report and therefore only references to the company will be made in these cases.

Examples from Europe and the US are going to be presented as successful stories to motivate local enterprises to implement CMS.

1.5 Research contribution

It is expected that this research will contribute to:

- Presenting the new concept for the Egyptian industries which will help in:
 1. Widening the vision of the industries regarding innovative business models that are different from the “business as usual” mentality.
 2. Motivating the local companies to analyse the CMS concept in detail and to find useful business opportunities to utilise the outcomes of ongoing projects in Egypt and successful cases from Europe and the US.
- Finding the opportunities for Chemical Management Services in the Egyptian industries.
- Facilitating the matchmaking between companies (CMS providers and customers).
- Presenting the criteria for a successful CMS implementation in Egyptian industries.
- Presenting the benefits and barriers for implementing the CMS model, and the deviation from the European and American examples.
- Strengthen the cooperation between EEAA and the National Cleaner Production Centre “Chemical leasing project-second phase”, through information exchange and implementation cooperation.

2. Chemical Management Services (CMS)

2.1 Chemical Management Services

Chemical Management Services is a new business model based on a long term relationship between customers and service suppliers, who both have the same goal of reducing the costs and volume of chemicals used in the customer's processes. The success of the new model is based on the aligning of the incentives of both parties and shifting the focus from the amount of chemicals used to the service/outcome they provide.

The model of CMS provides a chance for the service suppliers to cut down the costs of chemical production and the throughput.¹⁴ CMS combine three main approaches: Total Chemical Management, Third Party Logistics and Supply Chain Management.¹⁵

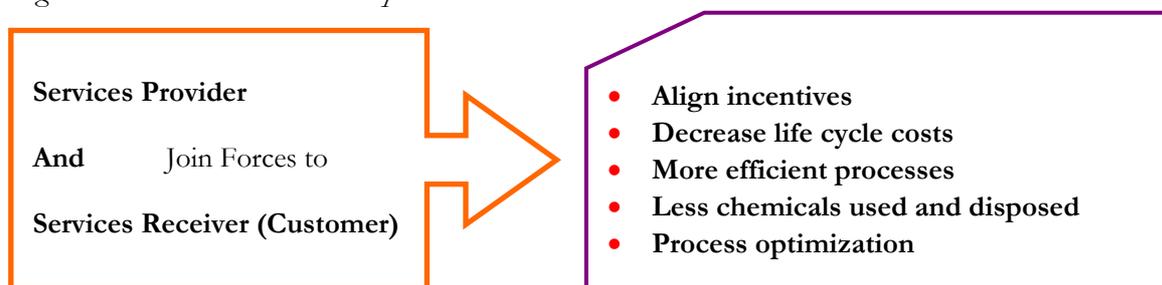
2.2 Why Chemical Management Services ?

Chemicals have a high importance for many industries, but during their life cycle the amount of chemicals released to the environment poses a serious threat to both human health and the environment. The main objective behind CMS is to reduce the adverse effects of these chemicals by reducing the amount of chemicals used.

The reduction of the amount and volume of chemicals used has negative consequence for chemical- producing industries, because their basic business model is based on the volume of chemicals sold. CMS provides a solution that allows the negative consequences for industries from the reduction of chemical volume sold to be avoided by shifting from a product-based market to a service-based market economy, which allows both interested sides to use chemicals with a maximum efficiency during the entire life cycle and boost their businesses.¹⁶

The CMS model creates a win-win business situation between supplier (service provider) and buyer (service receiver -customer), by giving financial incentives to reduce the volume of chemicals used and to increase the process efficiency. Supplier compensation is based on a service fee for managing chemicals, which is in turn based on a long-term relationship with customers, high level of trust and new business opportunities, in for example waste recycling and treatment. The following figure shows the relationship between supplier and buyer in the CMS concept:

Figure 2-1 CMS model relationship



¹⁴ Reiskin, E. D., White, A. J., Johnson, J. K., & Votta, T. J. (2000). *Servicizing the Chemical Supply Chain*. Journal of Industrial Ecology, 3(Number 2 & 3), 19-31.

¹⁵ Pranshu Singhal. IIIIEE Publications (2003). *Transition to Chemical Management Services: Opportunities, Barriers & Drawbacks in European Context*. Master Thesis Dissertation.

¹⁶ Bernard Siegele. (2005). *Presentation of Chemical leasing program in Egypt*, National Cleaner Production Center- April 2005

Adopting CMS has many benefits to service suppliers and service customers. Examples of benefits to service providers are:¹⁷

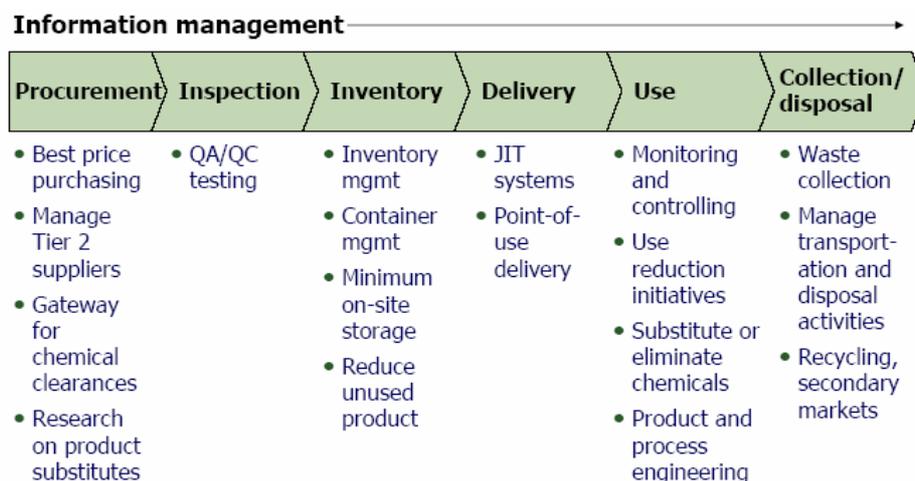
- Enhanced relation with service receiver and increased mutual trust.
- Financial benefits and prevention of price underbidding.
- Ensured growth in business through introduction of adding value products and especially services.
- Increased competitive position.
- Encouragement of research and development (R&D) and continuous improvement of products and services.
- Winning the loyalty and trust of the service receivers.

For service customers, benefits may include:¹⁸

- Enhanced relation with services provider and increased mutual trust.
- Better control and management of chemicals and processes.
- Realized real cost of chemicals and chemical management.
- Reduced chemical consumption and therefore cost of chemicals.
- Decreased liability for chemicals management and final disposal.
- Decreased emissions and amount of waste.
- Reduced health and safety risks.
- Better internal logistics for products and chemicals.
- Reduced number of suppliers, leading to reduction of management costs.
- Provision of updated data that can be used in voluntary environmental certificates.
- Continued improvement of processes, products and services.

CMS can cover a range of activities represented in figure 2-2.

Figure 2-2 Activities that can be included in CMS contracts



Source: a supply-chain approach to reducing chemical use, presentation (Jill Kauffman Johnson, 2003)

17 Csilla Magyar. (2006). Dow Europe GmbH "Dow Shares Experiences at UNIDO Chemical Leasing Event: First pilot results show significant potential for emissions reductions". Düsseldorf, Germany – Feb. 8, 2006. Can be found online: http://www.news.dow.com/dow_news/prodpub/2006/20060208a.htm

18 Business Editors. (2000). BUSINESS WIRE "Chemical Management Services Provide Bright Light in Stagnant Chemical Industry; Industry Report Finds Customers Reducing Costs and Chemical Use". SAN FRANCISCO, US -Nov. 9, 2000. Can be found online: http://www.findarticles.com/p/articles/mi_m0EIN/is_2000_Nov_9/ai_66758797

2.3 Types of contracts for Chemical Management Services

CMS is a new business model and needs to be supported by flexible and clear contracts to make it more attractive and to increase the opportunities for its adoption. As a financial business model used in many cases, CMS is generally based on the following guidelines according to Haas TCM:¹⁹

- Setting a baseline of CMS cost related to regular chemical usage pattern and related to entity production capacity.
- Benefits are connected to provided services (functional unit passed), so the baselines are more efficient processes and fewer chemical losses.
- The agreement and budget, contracted according to a settled target of savings.
- Saving below the settled target is shared by both sides (according to the contract).
- Management fees to cover the cost of on-site personnel and the services provided. The chemical manager is accorded a fixed fee for the services provided.

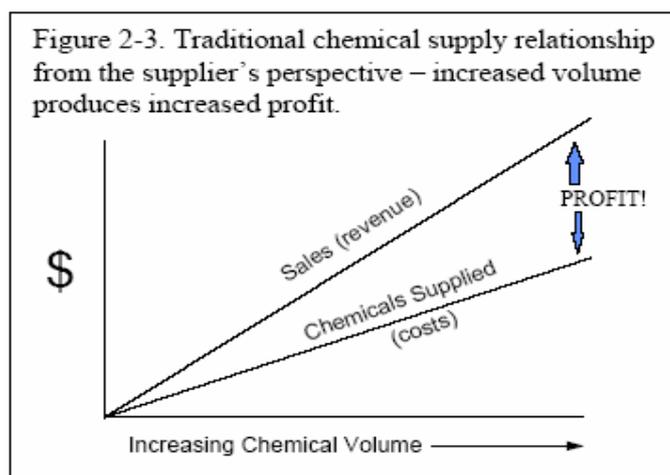
“Although the contracts differ quite widely in their specific details, they can generally be thought of as consisting of two components: a fixed part, which is essentially a service fee, independent of consumption of chemicals, and a variable part, which does depend on the consumption of chemicals. In the traditional setting, the fixed fee is zero, and the variable part is high enough to include a profit margin on the volume of chemicals sold. Under a CMS contract, the fixed fee is much larger, while the variable part is often small or zero, or sometimes even negative for CMS providers who arrange for disposal of chemicals after the customer has finished using them. If the variable part is smaller than the supplier's unit cost to produce or procure the material, the supplier has an incentive to exert effort to reduce consumption. The larger fixed fee guarantees profitability for the supplier even though it is selling the material "at a loss".²⁰

Figures 2-3 and 2-4 illustrate the traditional and CMS relationship from the service provider perspectives.

¹⁹ Klocek, S. (2003). Chemical Management by Haas TCM. *A case study of environmental improvement/presentation*. In Chemical Management Services, 2003, London.

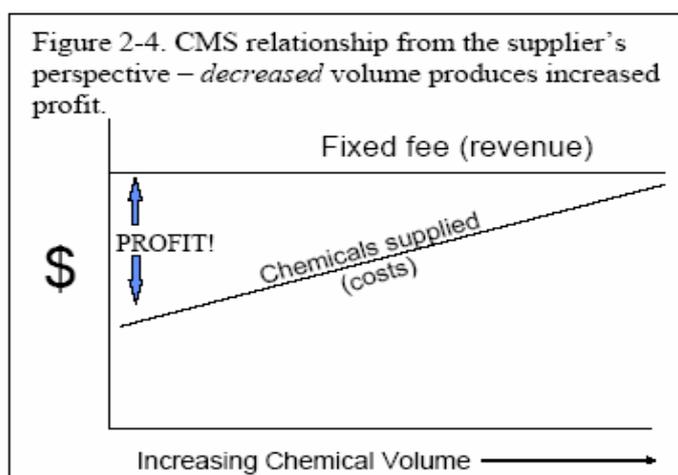
²⁰ Charles J. Corbett. (2006). Anderson Graduate School of Management, UCLA; and Gregory A. DeCroix, Fuqua School of Business, Duke University

Figure 2-3 Traditional model relationship



Source: *Chemical Management Services – Focused Studies* (Thomas J. Bierma Frank L. Waterstraat.2004).

Figure 2-4 CMS model relationship



Source: *Chemical Management Services – Focused Studies* (Thomas J. Bierma Frank L. Waterstraat.2004).

CMS contracts mainly include the following mechanisms:^{21,22}

1. Financial arrangements of CMS frequently refer to "shared savings", the idea being that both service provider and receiver help each other to achieve reduction targets and any benefits from this reduction are shared. In many cases the saving sharing can take different forms than the merely monetary. It can take the form of new re-design contract for more responsibilities in other production lines or providing chain steps, so the rewards are implicit rather than explicit.

²¹ Charles J. Corbett, Anderson Graduate, Gregory A. DeCroix, Fuqua. (2006). *Greening the supply chain: Shared savings contracts for chemical management services*. A study in School of Management, UCLA, School of Business, Duke University

²² Chemical Strategies Partnership (2006), *Tools for Optimizing Chemical Management manual*, section 6.5. Available on line at: www.chemicalstrategies.org/csp_manual.htm, June 2006.

2. Management fee is to be paid for the cost (or value) of the provided services. There are several types of management fees:²³
 - Fixed fee (e.g., USD 3,000 per month).
 - Variable fee (e.g., USD 20 per labour hour expended).
 - A combination of the above (e.g., USD 3,000 per month + USD 20 per labour hour expended).
 - Volume-driven (e.g., 20% of chemical purchase costs).
3. Chemical Purchase Cost Pass-Through: in this mechanism the service provider is transferring the real total costs of chemicals to the customer. In this case the provider is compensated for accompanying services.
4. Mandated Cost Reduction: the service provider commits to reducing the total costs of the contract by a certain percentage in a certain period of time.
5. Incentives for Reduction on Commodity Unit Price: a financial incentive to service providers towards reducing “last price paid” for chemicals by the customer.
6. Environmental Performance Incentives: a financial incentive to reach a reduction percentage on the environmental indicators (e.g. reducing air emissions, reducing chemical wastes).
7. Unit Price: agreed price per functional unit (e.g., USD 40 for each square meter painted).

There is also the implementation fee, which is a one-time fee charged to cover start-up costs of the program. It can be an advanced payment or it can be amortized during the life time of the contract.

The fundamentals of contract formation, practical operations and business management are:²⁴

- Top management understanding and commitment.
- Arranged letter of intent (LOI), request for proposal (RFP), draft scope of services, negotiated total chemical management services agreement (TCMSA).
- Creation of legal, valid and binding obligation enforceable by TCMSA terms.
- Prevent underbidding by implementing the best estimations, practical operations and proper allocation of legal rights and responsibilities.

To conduct a CMS program, the service customers may follow the next steps:²⁵

- Planning: form an implementation team.
- Prepare a Baseline Chemical Cost: according to processes mapping and costs accounting.
- Develop the scope of the program: select chemical or life cycle scope, develop RFP, create contract with incentive options.

²³ For variable and volume-driven, sliding scales can be used (e.g., 18% for the first \$1,000,000 of chemical purchases, 12% for the next \$250,000, 8% for the next \$250,000, etc.)

²⁴ Anders E. Stenstedt. (2005). MORRISON& FOERSTER LLP publication. *Driving Innovation in CMS Contracts Measurements, Remedies, Practical Solutions*

²⁵ Jill Kauffman Johnson. (2005). *Chemical Management Services: a supply-chain approach to reducing chemical use-Presentation*. 9th Annual CMS Workshop. San Francisco - US. October 2005

- Engage a chemical service provider: distribute RFP, select CMS provider and negotiate contract.

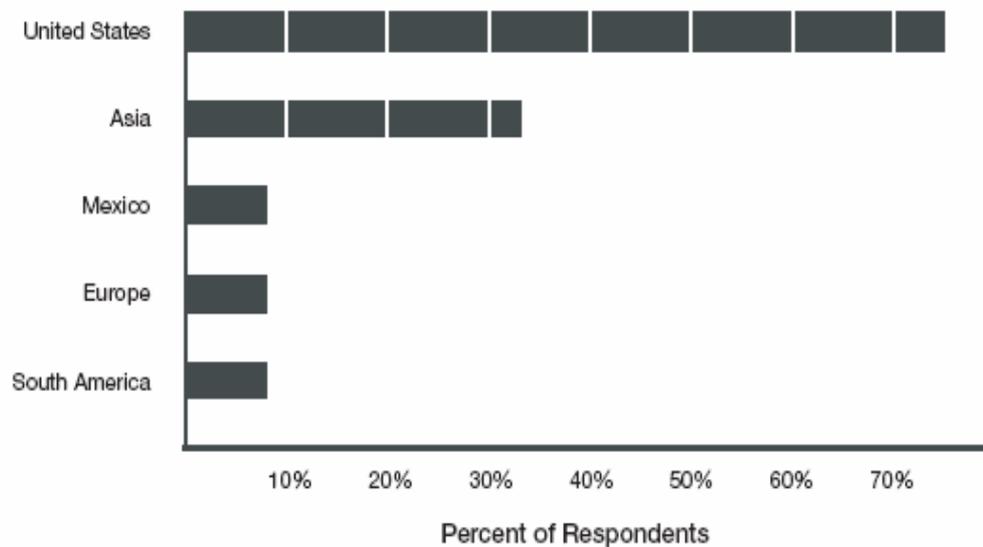
The main elements for a successful contract are:²⁶

- Having a clear vision (clear specifications, performance improvement plan and business concepts).
- Clear roles and responsibilities.
- Involvement of all departments in the contract discussions.
- Break the ice between the new service provider and employees and facilitate information flow.
- The contract should stand on its own and not be related to other contracts, or obligations may affect the conditions and responsibilities set inside the CMS contract.
- Create a win-win situation through the alignment of needs and incentives.

2.4 CMS worldwide

Chemical Management Services are growing worldwide. According to the Chemical Management Partnership industry report 2004, the highest growth in CMS is in the US, while other parts of the world are lagging behind. About half of the international CMS programs are run by multinational companies based in the U.S. Different programs can be found in Canada, Asia, Europe and Mexico. Figure 2-5 provides the regions where greatest growth in CMS is expected.

Figure 2-5 Regions where greatest growth in CMS is expected



Source : CMS Industry Report 2004

In the US, CMS has a steady growth. The growth was 50% from the year 2000 (approximately \$1.22 billion in 1999-2003), and expected to reach \$17-19.5 billion. Different industrial sectors joined and adopted CMS programs, for example automotive manufacturing, electronics, steel manufacturing, and aerospace manufacturing. Figure 2-6 illustrates the penetration of CMS in different sectors in the American market.

²⁶ Mike Meko. (2005). *Key Issues in Negotiating a CMS Contract*. 9th Annual CMS Workshop. San Francisco - US. October 2005

Figure 2-6 Providers' estimates of CMS penetration in key sectors in the US

Sector	Provider Estimates of CMS Penetration 2004	Provider Estimates of CMS Penetration 2000
Automotive	75-80%	50-80%
Automotive Suppliers	30-40%	Included in automotive estimate
Heavy Equipment	15-25%	15-25% (formerly metalworking)
Aerospace Manufacturing	25-30%	5-15%
Air Transport Maintenance	40-50%	10-20%
Electronics	30-40%	30-40%
Steel Manufacturers	20-30%	---
Energy/Utilities	Under 10%	---
Misc. Manufacturing	Under 10%	---
Food/Beverage	Under 10%	---
Research/Laboratory	Under 10%	---

Source: CMS Industry Report 2004 (2005 Update: 45% of Providers report serving 3 or more sectors)

In Asia, Singapore and China are the potential markets for CMS, especially in the electronics and automotive sectors. Few programs are initiated by local industries, but the majority of the programs are provided by multinational companies, based in the US. The growth of the CMS in Asia is slow due to:²⁷

- Low awareness of the service value and traditional preference for the commodity price.
- Few success stories in the market.
- The market is busy with the manufacturing growth, regardless of the business model change.
- Heavy capital costs to initiate CMS program in Asia, and lack of efficient infrastructure for logistics and warehousing.
- The CMS model, or even out-sourcing and in-sourcing, may not be accepted culturally.

In Europe CMS is not as widely present as in the US according to the available literature.²⁸ In the UK programs by Quaker Chemical Corporation/Toyota, BP Castrol/Airbus and PPG/OPEL are in different stages of implementation.²⁹ The UK government recommended

²⁷ Chemical Management Partnership (2004). *CMS Industry Report 2004*. Available to download online at: http://www.chemicalstrategies.org/industry_report_2004.htm. September 2006

²⁸ James, P., & Hopkinson, P. (2002). *Service Innovation for Sustainability: A new option for UK environmental policy*. Green Alliance. Available online at: [http://www.green-alliance.org.uk/Documents/Reports/service innovation for sustainability. pdf](http://www.green-alliance.org.uk/Documents/Reports/service%20innovation%20for%20sustainability.pdf) . (May. 2006)]

²⁹ Jennie Oldham. (2006). *Policy drivers and barriers to Chemical Management Services: A UK case study*. Green Alliance, UK

promoting CMS in suitable UK sectors.³⁰ The Austrian government is promoting a CMS model called “Chemical Leasing”. A study of chemical leasing estimated the potential reduction of one third of the current used chemicals that amounts to benefits of €24 million (Ecotec/Institute for Industrial Ecology, 2002).³¹ The Austrian government in cooperation with the UNIDO is currently implementing “Chemical Leasing” programs in Egypt, Mexico and Russia.³²

In Nordic countries service providers and receivers are international companies, which have high environmental awareness. Chemical Management Services were introduced in Nordic countries more than 10 years ago. Despite some barriers to implementing CMS program in Scandinavia, the opportunities exist for Nordic companies to get involved in developing and disseminating CMS due to fast industrial development and the involvement of policies to promote CMS. In addition, close relations between the EU countries facilitates the connection and information transfer between providers and customers.³³ Currently the Finnish government is revising the solid waste management plan, which promotes Chemical Management Services as a tool for the hazardous waste management.³⁴

2.5 Cases from Europe and the US

2.5.1 In Europe

The cases of service providers and customers (ABB, Dow Corning and Fuji) are selected from Pranshu Singhal’s thesis on the opportunities, barriers and drawbacks in a European context.³⁵

A- Service Providers:

Dow Company has provided CMS for more than four years around Europe. Their services include data management and Environment Health and Safety (EHS) services. Contract with clients are based mainly on the implementation fee and unit pricing (price/unit of function). The company is motivated to provide CMS as a means to reposition their brand, reach higher growth rates and to increase their employees’ capabilities in meeting customers’ expectations.

Many benefits are associated with implementing a CMS model, such as satisfying customer expectation, repositioning of their brand, and improving customer relations and strengthening customer trust.

Fuji Company is a Japanese manufacturing and service provider company. It started CMS programs for European customers 15 years ago. Their environmental strategy was the main

³⁰ Royal Commission on Environmental Pollution Report on Chemicals in Products. (2004). UK Government response report – Recommendation 43. August 2004. Available online at: <http://www.defra.gov.uk/environment/chemicals/pdf/rcep24-report.pdf>. September 2006

³¹ Jakl, Joas, Nolte, Schott, Windsperger. (2004). SpringerWienNewYork Publication. *Chemical Leasing: An Intelligent Business Model with a View to Sustainable Development in Material Management*.

³² Abu Sinna Ali. (2006). The National Cleaner Production Center. Personal meeting. Cairo - Egypt. June 2006.

³³ Mont Oksana, Pranshu Singhal and Dr. Zinaida Fadeeva. (2003). *Learning from Experiences: Chemical Management Services in Scandinavia*. OECD Conference “Experiences and perspectives of service-oriented strategies in the chemicals industry and in related areas”. Vienna 2003

³⁴ Rajmo Lilia. (2006). International expert and Finnish advisor for Nasrya Hazardous waste treatment centre in Alexandria. Personal meeting. Alexandria - Egypt. June 2006.

³⁵ Pranshu Singhal. IITEE Publications (2003). *Transition to Chemical Management Services: Opportunities, Barriers & Drawbacks in European Context*. Master Thesis Dissertation.

driving force for implementing such programs, in addition to providing an added value with its products. Fuji contracts are usually involved in the steps of purchasing, inventory, warehousing, handling and movement of chemicals, improving efficiency, data management and environmental and health safety.

The benefits of implementing the program include winning competitive advantage on the market, strengthening customer relations, substituting hazardous material, gaining an improved image and easing the control of chemical performance. In addition to this, Fuji gained savings from chemical reduction and waste recycling.

B- Service customers:

ABB Company implemented several CMS programs in their plants in Europe. The service supplier is required to minimise the usage of chemicals in addition to provision and safe handling of chemicals. The supplier is also helping in improving processes like the winding process. During the meetings of Mr. Pranshu with the ABB Company, the company's responsible claimed that barriers to implement the program were lack of suppliers for chemical services for all the required services, and resistance to provide CMS from the suppliers' side as it meant a change of management and personnel (specialists).

The company (ABB) clarified that the CMS program had many benefits, such as:

- Preventing the burden of the chemicals management lying within the company, since the supplier is responsible for that.
- Service supplier deals better with chemical management and environmental issues, which reduces liability (in some contexts) and risks.
- Supplier has financial benefits when implementing CMS.
- Long term contracting through CMS means a constant profit and loyalty from the service supplier.

Opel automobile factory in Poland conducted a CMS program with PPG as a service provider. In this case, PPG is integrated in the production. The contract includes the management of the direct materials, process management, mix room, logistics, storage, quality control, maintenance, cleaning, indirect materials, consumables and chemical management. The contract gives PPG the right to change (tier II) sub-supplier without consultancy with Opel. The Opel monthly savings from the program reached Euro 10,000.³⁶ The program gives the chance for process improvement from 50% to 95% and material substitution. Chloride loads in wastewater and sludge generation are reduced. The program offered consultancy in legal and hazardous material issues.³⁷

³⁶ Andy Benson. (2003). Account Manager, PPG Polska "Chemical Management Services Workshop: Greening the Supply Chain". Marriott London County Hall Hotel. Feb. 25, 2003

³⁷ Jennie Oldham. (2005). Green Alliance, UK. *Policy drivers and barriers to Chemical Management Services: A UK case study*. Presentation in 2005

2.5.2 In USA

A- Service Providers:

PPG Industries launched a CMS program as a provider with many customers like Opel automotive, GM automotive and Nissan. In 2003 PPG won an exclusive contract with Nissan for coating their cars. The contract covers the processes from pre-treatment to coating for about 2.6 mega square foot.

*"We're delighted to support Nissan's continued growth in North America," said Richard Zahren, PPG vice president of automotive coatings. "We're also very proud of the confidence Nissan has shown in us to meet all of its coatings needs at this key facility."*³⁸

Henkel Chemical Management is a services providing division of Henkel. It provides several chemical management products and services to the automotive, industrial, electronics and aerospace industries. Their services include inventory and supply chain reduction, regulatory compliance, environmental and safety support, on-site technical support and training.³⁹

Avchem limited services to procure and manage chemicals for the aerospace industry. Their services cover procurement, receiving and/or storing, material safety data sheet (MSDS), dispensing, point of use maintenance, tracking, hazardous waste management and training.⁴⁰

B- Service Receivers:

Chrysler Neon started a CMS program in cooperation with PPG service provider. The contract covers preparation, coating and treatment chemicals (excluding solvents). It assures proper chemical management, maintenance, testing, development of processes, training, improvement of product quality and increased sale costs of services. PPG is interested in product quality assurance since they are paid according to each "quality" car produced.

The benefits gained by the company were beyond the environmental and financial. In addition to the financial saving (USD 1 million. in the first year) and environmental improvements such as the reduction of Volatile Organic Compounds (VOCs), benefits included the reduction of demineralized water cost, improved inventory control, reduced inventory costs and improved health and safety protection. Furthermore, the company improved its image and was awarded four Illinois Governor's Pollution Prevention Awards.⁴¹

In Silao, Mexico, the **General Motors (GM)** engine plant has adopted a CMS program since it started production in 1994. The contract with the service provider PPG was based on process management and supplying a limited number of chemical products. In 2001 the contract expanded to cover a full CMS. The program was implemented on the body workshop (welding, turning, etc), assembly plant, stamping plant, plant engineering, paint shop, engine plant, and

³⁸ PPG web page. (2006). Available online at:

<http://corporate.ppg.com/PPG/Corporate/AboutUs/Newsroom/Corporate/default.htm> . June 2006

³⁹ Henkel web page. (2006). Available online at:

<http://automotive.henkel.com/Services/Chemical+Management/Overview/Services.htm> . September 2006

⁴⁰ Avchem web page. (2006). Available online at: <http://www.avchem.com/Solutions/> . September 2006

⁴¹ Chemical Strategies Partnership web page. (2006). Case Studies: CHRYSLER NEON - 2006

other areas. The program is assuring continual processes improvement, improved efficiency, cost savings and increased benefits for both sides.

The benefits of the program are an increase of paint sludge dryness from 40% to 55%, space optimization and reducing the costs of oil water treatment by 80%. Cost savings were 23% and 18% for the years 2002 and 2003 respectively. A new contract was proposed for the period 2004-2006 with projected costs reduction for the customer from 6-9%.⁴²

Seagate is a worldwide leader in design, manufacturing and marketing of hard disc drives. The annual revenue is more than a billion USD. The company spends about USD 54 million on chemicals in its 18 worldwide sites. The chemicals are provided by more than 300 tier 1 suppliers. The company conducted a CMS program for the external and internal risk management, inventory management and for e-procurement.

The program provides a clear vision about chemical lifecycle, allowing the company to focus on its core business, to reduce the chemical use-handling and onsite inventory, improve chemical processes, stimulate technology transfer, develop standardized chemical process worldwide, guarantee savings and enable e-procurement.⁴³

⁴² 8th Annual Chemical Management Services Workshop. (2004). *CMS: The Fundamentals and the Future Arlington, Texas* October - 2004

⁴³ Ken Storer. (2005). Seagate senior director. *Chemical Management Services. Presentation on the 9th Annual CMS Workshop-2005*

3. Chemical Industry in Egypt

3.1 Industry in Egypt

The Egyptian economy was reliant on the public sector, especially after the 1952 revolution. For about forty years public sector played the main role in the Egyptian economy, since it represented 80% of the industries up to the beginning of the 1980s.⁴⁴ Starting from the early 1990s, the Egyptian government started reforming and restructuring programs with the support of the World Bank and International Monetary Fund. The new Ministry of Public Enterprises was established in 1991 aimed at reforming, adjusting, privatizing public sector, liberalizing trade, developing exports and promoting environmentally sound technology.⁴⁵

The development of industries passed through several kinds of economic reformation, from the social economy to the free market economy. The evolution of industrial policies for developing countries (1960-2000) which is typical to Egypt is shown in table 3-1.^{46,47} The policy from 2000 is still in use now, in 2006.

Table 3-1 The evolution of Industrial Policies in Egypt (1960-2000)

1960's-1970's	1980-1995	1995-2000
Intervention and regulation	Market orientation and deregulation	Industrial governance
Self sufficiency and indigenization public ownership	Foreign Direct Investment	Privatization and Foreign Direct Investment
Import controls and tariff protection	Trade and investment liberalization	Promotion of clusters
Inward-driven industrialization	Outward orientation	Supply –side support fro Small and Medium Enterprises
Industrialization to achieve structural transformation	Promoting efficient industries	Global Competitiveness

Due to the recent industrial policies, such as the promoting of privatization, the attitude of the industrial enterprises improved leading to better production, business and relation with customers.

The chemical industry is the third biggest in Egypt after furniture and textiles. Chemicals are used in high quantities in the largest industries in Egypt such as those producing textiles,

⁴⁴ Privatization in Egypt. (2001). Quarterly review- Privatization coordination support unit – Cairo, June 2001.

⁴⁵ UNIDO publication (2001). Country Service Framework – Egypt. 2001

⁴⁶ UNIDO publication. (2000). African Industry 2000: The Challenges of Going Global. Vienna - Austria. February 2000. Order online at: <http://www.unido.org/doc/4215>. September 2006

⁴⁷ Amin Mobarak. (2001). *The Challenges of Sustainable Industrial Development in Egypt*. A country Paper for the World Summit on Sustainable Development (WSSD), October 2001.

fertilizers, metallurgical and automobiles. Unfortunately there is no accurate estimation for the quantities of chemicals used in Egypt.

Chemicals consumption is not optimal mainly due to four reasons:⁴⁸

1. Cultural

The traditional means of technical knowledge generation relies on the accumulation of experience gained by working practically. The old generation of technicians provide their experience orally to the new generation. That happens without any questioning for the accuracy of the old information delivered. That is why till now we can find some basic ideas like “ The more the better, the old knows better, the process is working good like this, we know better our processes, I do what my boss says, and so on”.

Language is another problem, since manuals, process descriptions and operation guidelines are not available in the employees' native language, Arabic. Only highly educated engineers are able to understand and translate this information. This problem causes a time loss in understanding the procedure, mistakes and is considered a major barrier to dealing efficiently with the processes.

2. Financial

The industries focus only on the clear costs of chemicals (purchasing costs). However, if companies would start considering the hidden costs of chemical management such as procurement, transportation, inventory, delivery, use, data management, disposal and liability, they would have realised that the hidden costs of chemical management are much higher than the “chemicals purchasing cost”. Hidden costs are like an iceberg.⁴⁹ The ratio of chemicals-related hidden costs to the purchase price has been estimated to range from 1:1 to 7:1 (spending USD 7 to manage a chemical for every USD 1 spent for chemical purchase).^{50,51} When the price of chemicals is increased, industries transfer it to the customers, instead of looking for the reduction of expenses inside their processes and internalising externalities. On occasion, low chemical prices may well prove to be a driving force to careless consumption.⁵²

⁴⁸ Interviews with chemical sector workers and managers in textile, chemical, metallurgical and petrochemical sector.

⁴⁹ Thomas J. Bierma Frank L. Waterstraat.(2004). *Chemical Management Services – Focused Studies* Illinois State University Normal, Illinois April 2004

⁵⁰ Mishra, P.N. (1997). Chemical Management Best Practices, at Chemical Management Services: Strategies for Chemical Use Reduction, a workshop sponsored by the Chemical Strategies Partnership, San Francisco, CA, 20 Nov., 1997.

⁵¹ Votta, T.J., Broe, R., Johnson, J.K., White, A.L. (1998). *Using Environmental Accounting to Green Chemical Supplier Contracts*, Pollution Prevention Review, 8, 67-78. 1998

⁵² Smair Mowafee. (2006). International Expert and EEAA advisor. Personal meeting. August 2006.

Figure 3-1 Visible and hidden costs of chemical management



Source: Thomas J. Bierma Frank L. Waterstraat. (2004), Illinois University

3. Technical

The handling of chemicals is controlled by several experienced industries, especially the amounts added to the processes, since it affects the products directly. But for the other parts of the life cycle of chemical management, such as storage of raw material or disposal of wastes, the awareness can be considered very low. The industries claim that mismanagement of chemicals in any step other than the one directly affecting the final product quality shall be considered a secondary priority.

Some companies are using excess chemicals to overcome the failure of other processes. For example, a white appliance production company may use more paints in the coating step to hide the failure of surface cleaning processes, which may occur due to the use of low quality raw materials or cleaning solvents. In some cases the low cost of certain chemicals encourages the workers to deal with it carelessly.

Some chemical providers are promoting and supporting the use of more chemicals with low price and quality. They also use the low awareness of the users to sell more chemicals not necessary for the production of the latter. For example, some companies supply chemicals that help wastewater treatment plants to settle the particulate, regardless of the fact that a specific size of the particulate allow free settling within suitable certain retention time.

4. Managerial

The leadership of the companies uses old models in the management of the entities. One of these strategies is based on avoiding suggestions of others related to the company “because managers know better”. The managers claim that spreading information and data related to processes may affect competitiveness, so it is better to “work as usual”, since the company is still in the market.

In CMS model chemicals and their services become an operational cost to the supplier (service provider) instead of the customer. As with labour, utilities and other material inputs, the supplier now has an incentive to use fewer chemicals to yield higher marginal benefits. The supplier becomes an integral part of the business by providing a differentiated, value-added service. Customers (industrial enterprises) win a partner in their efforts to manage

chemicals more efficiently.⁵³ The difference between the traditional business approach and the new CMS approach is summarized in table 3-2.

Table 3-2 *Shifting from traditional approach to CMS model*^{54, 55}

Traditional Approach	CMS Approach
<ul style="list-style-type: none"> ➤ Focus on the chemicals costs (visible costs only). ➤ Costs based on volume. ➤ Discounts based on selling amount (volume). ➤ User-driven chemical management. ➤ Personal interest negotiations. ➤ Different financial incentives. ➤ Fragmented approach. 	<ul style="list-style-type: none"> ➤ Focus on the lifecycle costs (visible and hidden costs). ➤ Unit-pricing: the costs are based on units of service delivered (functional unit). ➤ In shared savings case: the savings made at the customer's site by process efficiency, better management, reducing the costs, etc are shared between the customer and the CMS provider. ➤ Supplier-driven chemical management. ➤ Common interest negotiation. ➤ Aligned financial incentives. ➤ Systematic approach.

3.2 CMS in Egypt

Although not referred to as 'CMS', some cases in textile, petroleum and industrial wastewater treatment producers use models which can be seen as relatively similar to a Chemical Management Service model.⁵⁶

⁵³ Jill Kauffman Johnson. (2006). Executive Director, Chemical Strategies Partnership, CSP web page. May 2006

⁵⁴ Votta, T. (2003). Chemical Management service: green the supply chain workshop. "What is Chemical Management Services"? London-UK. February 2003

⁵⁵ Pranshu Singhal. IIIIEE Publications (2003). *Transition to Chemical Management Services: Opportunities, Barriers & Drawbacks in European Context*. Master Thesis Dissertation.

⁵⁶ Personal meeting with petroleum, textile and printing sectors. June 2006

3.2.1 Chemical Leasing Program

A program under implementation in Egypt is called “Chemical Leasing (ChL)” and is supported by the Austrian Government (and is also implemented by UNIDO in Mexico and Russia).⁵⁷ In this program, the chemical leasing is considered to be “a service-oriented business model that shifts the focus from increasing sales volume of chemicals towards a value added approach and the producer mainly sells the functions performed by chemicals, and the functional unit is the main basis of payment”.⁵⁸ The program in Egypt started about one year ago with the goal of introducing the Chemical Management Service new business model to local industries. The program comprises four pilot projects, all at different stages of implementation. The pilot projects are presented in the following table.

Table 3-3 Chemical Leasing Pilot projects in Egypt and Industrial Processes in focus

Service Provider	Industrial Process	Service receiver
Zinc Misr	Galvanization Process	El Sewedy Arab Steel Fabrication Co.
Coatech/AkzoNobel for Powder Coating	Powder Coating	Unionaire Air Conditioning Co.
Coatech/AkzoNoble for Powder Coating	Powder Coating	ABB Arab
Dr. Badrawi for Chemicals	Automotive Painting	General Motors (GM) Egypt

Source: Egyptian National Cleaner Production Centre Activities Presentation (Hanan El Hadary, May 2006).

3.2.1.1 Zinc Misr – El Swedy Arab Steel Fabrication

Zinc Misr Company is working as the service provider to El Swedy Arab Steel Fabrication Company. Cooperation between the two companies covers the following steps of the galvanization process:

- Flux production
- Hard zinc sieving and recycling
- Recycling of zinc ash
- Recovery of HCl.

Zinc Misr treats the waste, so part of the treated waste is reused in El Swedy factories while the other part is used by Zinc Misr in their production.⁵⁹ The contract between the two companies is under negotiation, but will not include the process modification, which is expected to weaken the pilot project.

3.2.1.2 Coatech/AkzoNobel – Unionaire air conditioning Co.

Coatech / Akzo Nobel is a joint venture company between a national company (Coatech) and an international company (Akzo Nobel Power Coating Ltd.). Akzo Nobel, the mother company,

⁵⁷ Hanan El Hadary. (2006). National Cleaner Production Center (NCPC) Director. Personal meeting in June 19th, 2006

⁵⁸ P. Schwager. (2006). *Presentation on Definition of Chemical Leasing and Introduction to Project Progress*. In NCPC dated 9 June 2006.

⁵⁹ Basem Nagi. (2006). Zinc Misr company general manager Phone call. July 2006.

showed high interest in the new pilot project. “It was one of the first things, I asked about after joining Coatch, since we are doing that in Europe in another way,” stated Mark Reekie⁶⁰.

Akzo Nobel agreed to provide a package of services to the Unionaire air conditioning Company that includes provision of powder coating, technical assistance and collecting the wastes from the coating and recycling certain portions. The recycled portion should be clean, in order to not affect the recycling process in Akzo Nobel factories. The project is pending implementation, due to the summer season and the dramatic need to produce high number of air-conditioning units.

3.2.1.3 Coatech/AkzoNobel – ABB Arab

An agreement between Akzo Nobel Company and ABB Arab Company to implement ChL project with the aim of achieving the following:

- Optimization of the electrostatic powder coating process at ABB ARAB
- Optimization of coating powder product at Akzo Nobel
- Recycling of powder waste (fine powder) at Akzo Nobel
- Establishing a new business model based on the chemical leasing concept.

Under the new project contract Coatech/Akzo Nobel will provide a certain number of coated m² per day against a fixed price. The service offered by Akzo Nobel includes the know-how transfer of its coating powder, improvement of the quality of the products and reduction of waste.⁶¹ A preliminary project benefit is the reduction of coating wastes form 10% to 5%.⁶²

3.2.1.4 Dr. Badrawi for chemicals – General Motors

Dr Badrawi is a medium size private company specialized in manufacturing chemicals used for metal finishing (phosphating, electroplating, cleaning with organic solvents, pickling and degreasing) processes. This company is providing solvents for cleaning of the painting guns in the GM company painting house.

The objectives of cooperation between GM Egypt and Dr Badrawi are:

- Recycling of solvent waste from automotive paints
- Optimization of the chemicals management
- Handling and application of organic solvents
- Establishing a ChL business model between GM Egypt and Dr Badrawi.

The proposed ChL contract is under design. It is still not clear what functional unit (m² painted, unit produce) will be used.⁶³

3.2.2 In textile sector

Several companies have been providing services like preparation and finishing for different spinning and weaving companies since the late 1970s. Private companies such as the Hesny Group in 10th of Ramadan City, Mardine in 6th of October City and the Engineering Company in

⁶⁰ Mark Reekie.(2006). AKZO NOBEL Business Service Manger – Europe. Personal meeting in NCPC. July 2006.

⁶¹ Ahmed Ismail (2006). Project consultant. Technical report presented for ENCPC. April 2006

⁶² Ashraf El Wassify.(2006). AKZO NOBEL Egypt – Technical Manger, Deputy general manager Personal meeting. July 2006.

⁶³ UNIDO case study (2006). Dr. Badrawi-GM ChL case study prepared by ENCPC. July 2006

10th of Ramadan City are providing the services of preparation (e.g. cleaning, mercerizing and bleaching), dyeing and finishing (the addition of chemicals to give textile special features including water repellence, shining and anti-shrinking) for other companies (and for their own weaving and texturing factories outside the servicing factories). The customers are paying service providers for each m² of textile and each ton of knitted wear (tricot) produced to the desired quality. Customers (CMS receivers) are asking for one or several services from the providers. Relations between customers and providers are based largely upon trust, and thus lack clear agreements or contracting. So services are provided without special contracting, but only through “working orders”.⁶⁴ In this case, service providers supply chemicals, and provide process management services and waste treatment for the clients.

Despite the benefits of outsourcing some manufacturing steps in the textile production, there are still only a few large spinning and weaving complexes that fully depend on internal services. Examples from the public sector include Misr Spinning and Weaving Co. in Mahalla City and Misr Amria Spinning and Weaving Co. in Alexandria. Also some private companies such as Normidas in new Salhia City produce cloths starting from spinning and weaving processes.⁶⁵

3.2.3 In wastewater treatment

In some cases, it was found that industrial enterprises are installing wastewater treatment plants which are totally managed by the supplier. The Nile Pharmaceutical Company is an example that installed industrial wastewater treatment plant in their factory in the Sawah area, which was managed totally by the supplier (Mettito Egypt) via certain annual payments. Other companies like Unilever Egypt in 6th of October City and Master Foods in 10th of Ramadan city have long-term contracts for the total management of their industrial wastewater treatment plants via yearly fixed fees.⁶⁶ Another example is the IWWTP implemented by NIJHUIS water technology Egypt at the Al Ahram Beverage Company in Badr City.⁶⁷

3.2.4 In the petroleum sector

Several companies are providing services to petroleum drilling, oil transferring and processing companies. Services mainly cover maintenance, processes management and production. In some cases service providers are providing full services to petroleum processing companies. The contracting covers several services including a total chemical management system (no special contract for CMS) against yearly fixed fees.⁶⁸

3.3 Opportunities for CMS in Egypt

The author has completed a limited survey of several industries – potential customers and providers of CMS. The survey was conducted based on interviews with industry representatives, analysis of available documentation from industries, and communication with experts.

The potential of the selected providers to offer CMS model was determined in accordance with the following criteria:

⁶⁴ Alla Tawfik.(2006). Hesny Group Environmental Manager. Personal meeting. June 2006.

⁶⁵ Hussain Sabry.(2006). National textile expert. Personal meeting. June 2006.

⁶⁶ Amr Azam.(2006). METTITO Egypt. Senior sales Engineer. Phone call. July 2006

⁶⁷ Samia Othman.(2006). NIJHUIS water technology Egypt Engineering Dept. GM. Phone call. July 2006

⁶⁸ Hamdan Nour El Din.(2006). Midom services company Vice director. Phone call .July 2006

Technical criteria

- Technical support for identifying the suitable customers

Financial criteria

- High chemical volume (sold or produced)
- High chemical financial value
- Cost reduction pressure from the market or competitors
- Presence of financial incentives

Facility criteria

- Experienced local, international or multinational company
- Accepting the adoption of the model
- Presence of independent third party during the process to build up trust levels

The potential of the selected industries (customers) to shift to CMS model was determined in accordance with the following criteria:

Environmental and Technical criteria

- Criteria for chemicals in the model shall be specific (i.e. valuable, toxic, specialized)
- Presence of an environmental regulatory pressure
- Technical support for identifying processes or applications in the supply chain suitable for the model.
- The process shall consume chemicals but must not affect the entity's core business
- Environmental improvement pressure from the top management, the mother companies or the customers.

Financial criteria

- High chemical volume (consumed)
- Presence of financial incentives
- High chemical financial value
- Cost reduction pressure from the management or the mother companies

Facility criteria

- Large facility size or different factories of the same company
- Accepting the adoption of the model
- Presence of independent third party during the process to build up trust

Nominated sectors are represented in the following table.

Table 3-4 Industrial sectors and processes in which CMS model can be implemented

Industries sector	Processes
Textile	Dyeing and printing process
Carbonated beverages and breweries	Bottle washing and CO ₂ production
Plastics manufacturing	Polymers and additives
Water treatment	Boiler water treatment and industrial wastewater treatment
Paints Industry	Decorative paints
Engineering Industry	Fabrication metals
Tanning	Chemical treatment

3.3.1 Textile Industry (Dyeing and Printing process)

As mentioned in section 3.2.2, some companies are providing services like preparation and finishing for some customers. These companies are expanding and introducing other processes into the industry including printing and cone dyeing. Expanding the activities in the textile servicing companies may cause some problems in the new activities since they are not the main or a core business. Meetings with textile companies providing services and companies that manage the whole range of processes from weaving to cloth manufacturing revealed different opportunities for the CMS model to penetrate the textile sector.

The chances of implementing a CMS model appear to be promising for several reasons. Firstly, in the companies that control the whole processes (from yarn spinning to clothes manufacturing); it was found that it is difficult to control the different lines and reach the designed efficiency for each process. The efforts of the management are scattered around the factory. Companies like Mirs Amria Spinning and Weaving Co., the second largest public company in Egypt with more than 6000 employee, showed a positive attitude to the CMS and outsourcing. On the other hand, they complained about security issues. The company stated, *“We are supporting outsourcing without compromising our security and know how”*.⁶⁹

Secondly, in companies providing special services like preparation, finishing and dying processes, CMS can occur inside one of the lines as a pilot project or within one of the side processes such as printing, but detailed cost benefit analysis would need to be carried out first.

As mentioned previously, the services provided are based on “working order” and not clear contracting. To overcome this issue, the pressure of importing companies requesting that all the documents related to the supply chain be shown can be used efficiently. These companies are sending auditors to screen the processes and usually ask for the contracts with the clients to revise the relationship between the company and their clients.⁷⁰

At the same time, the CMS model may face some difficulties. For example, in some cases companies claimed that they themselves were more professional than anyone else, and that they could reach the design performance or better. In addition, CMS leads to a reduction in the number of chemical suppliers, which could affect the relationship with the suppliers.

Some service providers to textile companies do not care much about the efficiency or the first class quality of products. So if they received a material and then failed to reach the desired quality, they could deal with it by introducing it to the local market which has a very high capability to absorb second and third class quality products.⁷¹ Second and third level quality products are the main sources of the largest markets and “bazaars” in Egypt such as “Wekalt El Balh and El Atabbah” in Cairo and “El Manshiah” in Alexandria.

⁶⁹ Mohamed Amin.(2006). Misr Amria Spinning and Weaving Company engineering department general manager. Personal meeting, June 2006

⁷⁰ Alla Tawfeek.(2006). Hesny Group environmental manger. Personal Meeting, June 2006.

⁷¹ Hussain Sabry.(2006). Textile expert and industrial specialist – Industrial unit EEAA. Personal meeting, June 2006.

3.3.2 Beverages and Breweries (Bottle washing and CO₂ production)

Bottle washing is one of the main processes in the beverage and breweries industry. Most of the beverages and breweries glass bottles are returnable. The returned bottles are cleaned to eliminate dirt and traces of the old filling. Caustic soda in a certain concentration is the main chemical used.

With the increase of the collection of glasses and continuous production, there is a greater need for caustic soda. “*CMS seems to be a promising idea and can be studied*”, stated Mr. Yousry Thabet⁷² from El Ahram Beverages Company. The success of the CMS model may depend here on the implementation of the model in several factories that belong to the same owner (e.g. Al Ahram Beverages).

Another opportunity for the CMS model to be used is in the Carbon dioxide (CO₂) production line. In this process chemicals like mono ethanol amine, potassium permanganate and aluminium oxide are used. These materials are used for the separation of CO₂ gas from the other gases.⁷³ The presence of these chemical providers and the large number of beverages companies in Egypt make the chances of implementing a successful CMS model in this sector a possibility.

3.3.3 Plastics Manufacturing (Polymers and additives)

The plastic manufacturing industry is a promising sector for implementing the CMS model since it uses a lot of chemicals like polymers and additives, in addition to the presence of many plastic manufacturing facilities in Greater Cairo, Alexandria and the new industrial cities, numbering around 1,400 enterprises.⁷⁴ Plastics used for parts in electronics and household appliances need to have certain amounts and kinds of additives used in the mixture with polymers.

Polymer producers (service providers) claimed that the user of their raw material does not process it correctly, causing the loss of product quality. Mr. Agrwal from El Mansoura resins company stated that “*In some cases, the users of our raw material claimed that the raw material is not good, and with a further investigation we found that the users are not following the correct processing instruction, we provide them with the technical assistance they need for free till they reach the optimal processing conditions*”.⁷⁵

Plastics manufacturing companies showed a willingness to narrow the suppliers of raw material, under the condition of long term contracting with certain prices, quality and services. Changing the raw material and mixing raw material from different suppliers causes problems in the manufacturing processes and in the final products, so it is preferred to use the same raw material from the same suppliers unless new products with new mechanical and physical properties demand otherwise.⁷⁶

3.3.4 Water treatment (Boiler water and industrial wastewater treatment)

Most of the production industries are using boilers for the production of the steam and superheated steam needed for heating and direct injection within their processes. Water used in these boilers should be treated to prevent scaling and corrosion of the pipes. Scaling causes

⁷² Yusry Thabet.(2006). El Ahram Beverages Company, Sharqya Plant-Utilities Manger. Personal Meeting. July 2006.

⁷³ Carbonated beverages self monitoring manual. (2002). Egyptian Pollution Abetment Project Publication. June 2002

⁷⁴ Ministry of Trade and Industry - General Organization for Industrialization (GOFI), Industry data base. July 2006

⁷⁵ H. K. AGARWAL.(2006). El Mansoura Resins vice general manager. Personal meeting. June 2006

⁷⁶ Husam Abdul Rahman. (2006). Plastic Manufacturing expert and production manger. Personal Meeting. July 2006

losses in heat transfer and sometimes the blocking of pipes, leading to explosions. Corrosion leads to penetration and steam losses, causing financial losses and risks. That is why special additives and chemicals are added to the water before it is sent to the boiler. Some companies are still using anti corrosion, anti foaming, anti rotting and conditioning (hydrazine) chemicals when safer substitutes are available on the market.⁷⁷ Traces of these substances can contaminate the produced steam and could pollute the product whenever live steam is used in the production process.

Interviews with some major chemical providers used for boilers, showed different results. Some chemical providers are providing additional services for free (of course these prices are included in the chemical price), including maintenance, process optimization, chemical providing, analysis and chemical cleaning. *"We provide chemicals and service for more than 15 years"* Ramadan Amin, director of Housman Egypt Co., claimed.⁷⁸ *"We provide after sales service for free to our customers, because financial benefits is not our first priority. Our first priority is customers' satisfaction and trust"*, Mr. Ramadan proceeded. Before providing the services, the provider optimizes the process and ensures the efficiency of boilers.

In the above case, although the company is putting the customer's satisfaction as the first priority, surely the company is also gaining profits and the main evidence is that they are still in the market! The same company sometimes hires a full time engineer to stay in the customer's entity for continuous follow-up.⁷⁹ Continued monitoring and optimization leads to savings, which of course satisfies the customers. Despite the slow growth of their business relative to other companies in the same field, the Houseman Company are proud of their policy which allowed them to sign exclusive contracts with some companies and win the trust of major industrial producers in Egypt like Toshiba and Sharp.

Other companies, like METTTO (Libya and North Africa branch) and NIJHIS Water Technology Egypt Limited, have a different view. They are providing free services during the grantee period (usually one year), after which they are under call with a certain fee depending on the services needed. At the same time they provide full services under a long term contract for the full management of the units they provide in many cases. But some problems started to occur due to financial issues raised by the customers. Of course, other maintenance schools favour no additives for the boiler water and backwashing yearly in the maintenance period.

For industrial wastewater treatment, the success of implementing the CMS model to manage the whole treatment process and use square meter (m²) treated wastewater is dependent mainly on the type of industries. For example the wastewater from textile industries varies dramatically because the process is batch based. On the other hand, continuous processes in other industries may decrease the variation of characterizations of influent industrial wastewater. Technical ideas to overcome the variation wastewater from textile industries include setting the suitable retention time in the equalization tank in order to get an average influent. If these kind of ideas are not implemented the success of the CMS model decreases.

⁷⁷ Inspection manual for energy generating plants .(2002). Egyptian Pollution Abetment Project Publication. March 2002

⁷⁸ Amin M.A. Ramadan.(2006). Houseman Egypt Company, Director. Personal meeting. June 2006

⁷⁹ Ahmed Ramadan. (2006). Houseman Egypt Company, Deputy Managing Director. Personal meeting. June 2006

3.3.5 Paints (decorative paints)

The decorative paints industry is based on simple processes like milling and mixing. Liquid paints are a composite of a finely divided pigment dispersed in a liquid composed of a resin or binder and a volatile solvent. Therefore, paints are manufactured from three main constituents: pigments, binders, and solvents (thinners), in addition to many other additives to give the paints specific properties for specific purposes or applications.⁸⁰

The chances of implementing the CMS model is high as the producers are using dangerous materials in the content of the paint, for example in the pigment (titanium dioxide, chrome pigment, earths and lead pigments) and in the additives like driers such as cobalt, lead, zinc, zirconium and barium. In addition to this, raw material producers (providers) are usually more experienced regarding the type of application, and how and when the raw material should be used. In Egypt some raw material providers are involved with their customers on a long term basis called “projects”.⁸¹ These kinds of projects mainly cover supply and technical assistance for improving the production processes, but tend to exclude the collection and treatment of wastes.

An example of CMS implementation is the cooperation between BASF Egypt and Capci Co. for decorative paints. In this case BASF is providing pigments used in the paints production and supply technical and operational assistance for Capci Paints Company upon request. “*The relation between the two companies is unique, and we are providing green material to our customers*” a BASF representative claimed. Since large chemical providers like BASF, Dow and Cipa are not involved in the treatment of hazardous or industrial wastes generated from their client in Egypt,⁸² the chance of CMS model implementation may exclude the waste chemical collection and disposal step.

On the other hand, problems such as the absence of resident technical staff in these chemical providing companies in Egypt may limit the speed of the CMS implementation in this sector. The need for low grade raw material in the informal industries and bulk sales ideas, are also tending to reduce the likelihood of successful implementations of CMS.

3.3.6 Engineering Industries (Fabricated metal)

The fabricated metal products industry comprises facilities that generally form metal shapes and perform metal finishing operations, including surface preparation. Consequently the main processes associated with this industry can be divided into three types of operations. Each of these operations consumes and uses different chemicals. The following table shows the different chemicals used in the operations.

Table 3-5 Material Inputs to Each Operation in Metal Fabrication

Operations	Material Inputs
Metal shaping	
Metal cutting/ forming	Cutting oils (ethylene glycol), degreasing and cleaning solvents (trichloro-ethane, methyl-ethyl-ketone, acetone.), alkalis and acids.

⁸⁰ Paints industry inspection manual.(2002). Egyptian Pollution Abatement Project publication. June 2002

⁸¹ Waleed Nasr. (2006). BASF Egypt The chemical company, Paints sales manger. Personal meeting. July 2006

⁸² Alla Othman.(2006). Huntsman advanced Material Specialty Chemicals (Ciba) - sales representative . Phone call. July 2006.

Surface preparation	
Solvent degreasing Emulsion degreasing	Solvents Organic solvents dispersed in water (kerosene, mineral oil, glycol)
Alkaline/acid cleaning	Alkali hydroxides, acids, organic and inorganic additives, surfactants
Surface finishing	
Anodizing	Acids (chromic acid, sulphuric acid and boric-sulphuric mixture), sealants (chromic acid, nickel acetate, nickel-cobalt acetate)
Chemical conversion coating	Solutions of hexavalent chromium, phosphate salts, phosphoric acid, nitric acid and sodium dichromate.
Electroplating	Acid/ alkaline solutions, heavy metals bearing solutions, cyanide bearing solutions.
Plating	Metal salts, complexing agents, alkalis
Painting	Solvents and paints
Other techniques	Metal salts and acids

Source: Fabricated Metal inspection manual (, EEAA. June 2002)

The Chemical Management Services model gives the opportunity to manage the different chemicals in a safe, economical and environmental way. Most of the chemicals used in this process can be produced locally. These local producers may be turned into service providers

3.3.7 Tanneries

Egypt produces about 9.1 million (m²) of chromium tanned leather annually. This industry is one of Egypt's oldest. Most of the tanneries are concentrated in the old Cairo area in addition to other tanneries in Alexandria and the delta region. In old Cairo, there are 301 micro and small tanneries.⁸³ An ordinary (that is, according to old techniques) tanning process consumes and uses several chemicals including hexavalent Chromium, hydrogen Sulphide and Ammonia.

Under the supervision of EEAA, old Cairo tanneries are going to be relocated to another suitable area. Implementing the Chemical Management Services model in the new tanneries can substantially help improve their processes and supply chain management. Large amounts and different types of chemicals are the main driving force to implement the CMS model. Since most of the tanneries are SMEs, the institutional system may be the main obstacle to implement the CMS.

⁸³ Saad Niel. (2006). Leather Tanning in Egyptian Federation. July2006

4. Advantages and barriers for CMS in Egypt

The adoption of the CMS model in developed countries is easier than in developing countries due to a number of reasons, including the presence of multinational and big international companies, adoption of Best Available Technologies Not Entailing Excessive Costs (BATNEEC) and Cleaner Production (CP) practices, high awareness and the support of governments in some cases.

To develop a suitable CMS model and to attract the companies, the advantages of CMS should be clear and the barriers against its implementation should be identified and overcome. From the several meetings with the companies in the implementation process of the CMS model and the companies planning to implement it, expected advantages and barriers for the CMS model in the Egyptian market have been identified.

4.1 Advantages of CMS in Egypt

4.1.1 CMS advantages for service providers

A. Improvement of chemicals used.

Close cooperation between service providers and customers gives the chance for continual improvement of chemicals used and for the introduction of the latest management practices. Providers try to introduce “added value” to their materials to users, and at the same time try to assist the users in modifying the processes to cope with their material.

Due to pressure from the government and customers, service providers are trying to deliver and switch to more environmentally sound materials and services. Some chemical substitutes may be more expensive, but with detailed calculations of the “total chemical management cost”, it will be clear that usually suitable “green” substitutes will reduce the total costs, including waste treatment and environmental liabilities.

B. Improved relationship with customers

Relations between service providers and customers are expected to improve due to a long-term relationship, mutual projects and continual close cooperation, in addition to the “win-win” scenario. Implementing the model will assure the loyalty of the customers and reduced competition with other providers because of the establishment of a long-term relationship and building of trust.

The relationship between the providers and customers is stressful. The providers try to “put pressure” on the customers and the customers try to “squeeze” the providers. With the new model both will work together in a cooperative environment reaching satisfactory deals for both sides.⁸⁴ Even the providers can offer innovative solution for some other technical problems away from CMS model for an additional customer satisfaction.

C. Decreased complaints from customers

Being close to the production and application lines in the customers’ site allows the providers to make suggestions for process, product and service improvements. Close monitoring of production lines allows the providers to reduce the customer’s complaints regarding the use of

⁸⁴ Ibrahim El Assar .(2006). Industrial consultant and Professor in Alexandria University, Faculty of Science. Personal meeting. July 2006.

raw materials and services, since the customers try to allocate responsibility for mistakes and product failures to the providers.⁸⁵

D. Attraction of other customers

Implementing successful cases will attract other customers to adopt the CMS model. Experience from cleaner production projects in Egypt demonstrate that Egyptian industries are fond of mimicking, especially in cases when they can gain financial and environmental benefits.

A representative of Akzo Nobel that provides coating chemicals and services and is one of the “Chemical leasing” companies, declared that he received offers from different customers to implement a pilot scheme in their facilities as a result of what they had heard of primary success results of the Akzo Nobel / ABB ARAB pilot project.

E. Improved environmental image

Service providers improve their environmental image since they are helping the customers in reducing the volume of chemicals used, in process improvement, waste minimization, in substituting raw materials, recycling and generally in ensuring a ‘greener’ supply chain. Good reputation will support their market position and improve their situation in competition with other providers.

F. Take the lead

Introducing new business model in the local market may include some risks. But the benefits expected from the success of the model may be higher than the risks of failure. Providers taking the initiative will have the advantage of gaining more experience and attracting more customers. Taking the lead in introducing new CMS models will help in strengthening the reputation of the providers. At the same time if the local provider is representing an international company, introducing a successful new model will support the representative’s situation and the positive image of the mother company.

4.1.2 CMS advantages for service customers

A. Introducing cleaner production and reaching maximum efficiency

Introduction of a CMS model in processes leads to the maximized efficiency of production and allows the implementation of ‘best available technologies not entailing excessive costs’ (BATNEEC) and ‘cleaner production’ (CP) practices. Processes optimization is the target of both providers and suppliers and may allow the reaching of maximum financial benefits and product and process quality.

The optimization of processes reduces waste and improves the working environment. In that way CMS implementation will reduce the risks of accidents in the facilities.

B. Costs saving

Implementing the model reduces the costs of chemical management. The model shall control the supply chain, leading to the reduction of costs during the life cycle of products. CMS helps customers to minimize losses and maintenance and to streamline production with the desired quality.

⁸⁵ K.N. Agrawal .(2006). Alexandria Carbon Black Company Managing Director. Personal meeting, July 2006.

C. Understanding of the real costs of chemicals used

CMS gives the real account of costs associated with chemical management. It widens the vision of customers about the hidden costs they pay for chemicals used, and allows them to choose a CMS contract type that reduces the amount of chemicals used and waste generated.

D. Use fewer suppliers

The new model reduces the number of providers and suppliers, leading to the reduction of management efforts related to chemical purchasing. Long term contracting with certain number of suppliers gives the customers more time to focus on core business activities.

E. Outsourcing model

Production industries are supporting outsourcing in Egypt. Many industrial enterprises depend on transportation, IT management and maintenance services supplied by other companies. Outsourcing reduces the costs associated with the total management of different operations. CMS can be considered as one of the outsourcing models for chemicals. With the clarifications of hidden costs and losses during the chemical life cycle, industries will shift to the new model in certain processes and sectors.

F. Relationship with providers

As mentioned in the providers' benefits, the CMS model improves the relationship between providers and customers. Improving the trust and increasing cooperation are the main drivers for new strong relations between the two parties.

G. Improved data management and soft-wear usage

CMS improves the data compiling, management and savings. Clear and organized data is one of the ISO 14001 requirements.⁸⁶ The new model includes tools that facilitate the gathering, handling and storing of chemicals in the facility. Organized data helps the industrial facilities in providing required data during periodic inspections by authorities.⁸⁷

H. Assured quality

Industrial enterprises can reach desired quality without compromising their costs, when implementing CMS. The new model assures quality especially with contracting that requires a certain quality for the payment to the service providers. Cooperation between providers and customers gives the chance of open discussion to reach products with high quality for the benefit of both.

In addition to this cooperation, providers help in exploring weak points in the production lines and in avoiding future mistakes.

I. Focus on core business

In some cases CMS can be implemented in processes considered to be secondary production. For example in pharmaceutical industries, the main business is production of medicines. At the same time they own an industrial wastewater treatment plant (IWWTP). The management of the IWWTP can be done by the service provider without affecting the main production business.

⁸⁶ Brorson Torbjorn, Gosta Larsson. (1999). EMS AB publication. *Environmental Management: How to implement an environmental management system within a company or other organization*. Stockholm 1999.

⁸⁷ Atef Yakob. (2006). Inspection department director EEAA. Personal meeting. July 2006

J. Transfer to other processes in the factory

A successful CMS model in one process in a certain sector can motivate the adoption of the model in other lines and processes. Customers can try the model in different processes and adopt the suitable contracting type for different lines and processes.

K. Support from authorities

Local authorities in Egypt, such as the EEAA, support companies to implement environmental chemical management strategies and plans. There are some programs to raise the awareness of the management of hazardous material and waste generated from the industries.⁸⁸

In some cases the customers may be responsible for the transportation of the wastes (usually hazardous). Special approval should be obtained from the Ministry of Trade and Industry to transport hazardous wastes, if the company is going to transport it in their cars. On the other hand, no special approval is needed if wastes are going to be transported by the “Nasrya hazardous waste treatment centre” in Alexandria against certain fees.

4.2 Barriers for CMS in Egypt

4.2.1 Barriers for service providers

A. “Selling more” mindset

Most of the chemical companies are focusing on selling more to reach the planned profits set by the mother company or the top management. These companies consider “selling more” as the way to maximise profits, regardless of the relationship with the customers. They like to widen their customer base, but not to establish a long-term relationship and continuous cooperation with them. The new model offers a long-term relationship with customers and a way of “selling less – earning more”, which is not yet understood by all the potential providers.

B. Hard to understand the concept

It is not easy to introduce the concept to the providers, since it shifts the basis of the traditional business model dramatically. The concept is hard to be understood due to the absence of success stories and examples from the local market. Very little expertise and training about the CMS model among the service providers is another reason for low awareness about the concept.

C. Absence of financial incentives

Service providers are not motivated since there are no financial incentives to cover the risks of trials of the model. They need financial aid or soft loans to implement pilot projects before using the model with different customers.

D. Volume and type of chemicals should be suitable

Implementing the model needs a certain amount and special types of chemicals. The CMS model is easier to implement in cases when large volumes of chemicals are traded and/or when special chemicals are used and need careful management and treatment. This kind of requirement decreases the chances of providers to adopt the model. “*This model does not suit us since we are using few chemicals*”, Ahmad Shehata from the Dr. Olivee Company stated.⁸⁹

⁸⁸ Tarek Eid.(2006). Hazardous material conventions coordinator director. EEAA. Personal meeting. July 2006

⁸⁹ Ahmad Shehata.(2006). Employees’ affairs manager and environmental department director. Personal meeting. September 2006

E. Risk of losing customers

Currently, most of the chemical providers are providing additional services to customers for free. They are afraid to change the relationship and the business model with the customers. Customers may change the chemical providers if they did not understand the concept clearly. To assure loyalty, some companies like Dow are providing free technical assistant for the customers as long as they order chemicals.⁹⁰

F. Lack of trust from the customers

Chemical providers do not trust the customers during implementation of the new concept. They are expecting carelessness from the customers since it is not affecting the core business of customers. Also they are afraid that the customers do not follow the contract requirements, causing a lot of problems.

For example, in powder coating, the process depends on several conditions including the type of coating and the speed of production line. For service providers the speed should be constant and suitable for the type of coating. In some cases customers increase the speed of the line to produce more, causing problems in the final product.

G. Weak competition

Competition between CMS providers is not strong. They are still of a limited number with a certain share of the market. The production market is expanding and ready to absorb more providers. So the providers are not facing a strong pressure from the market to find new added value services and business models.

4.2.2 Barriers for service customers

A. Hard to understand the concept

As with the providers, understanding the concept for customers is hard. With the lack of understanding of the model, customers' management prefer to "work as usual" and do not want any new ideas in the old continuous stream of work and production.

B. Fear of losing the control over the processes

Since the model opens up the cooperation between the providers and customers on process management and optimization, the customers are afraid of pressure from the providers to change the processes to suite the provided material. In addition to that, service providers may conceal some industrial secrets to protect their material know-how. After a while the providers may control the process totally, including controlling the product and the brand name.

C. Multi-Management problems

In the model both service providers and customers are negotiating and cooperating regarding the management process. Different ideas and inflexibility may cause problems for the model implementation. This is because of weak trust, a lack of willingness to talk openly and to admit the mistakes in cases of failures.

D. Limited number of providers

Although the fewer providers there are the lower the costs for supplier management, some customers would like to have a long list of chemicals and service providers to be able to choose from.

⁹⁰ Salah Marwan .(2006). Dow Egypt. Factory general manager. Phone call. July 2006

Usually in industrial facilities, the purchasing department is the one responsible for buying chemicals. Purchasing departments sometimes encourages different and several sources to decrease risks of shortage, put pressure on providers and to reduce corruption.

E. Customers can do it better than providers “sometimes”

Some Egyptian companies showed high standards of chemical management strategies and implementation. These companies assume that they can achieve the model targets and benefits alone and better than the service providers without implementing the new model, because they have the capacities and the financial abilities.

F. Financial problems

In some cases customers need to optimize their processes or implement pollution abatement and cleaner production projects before introducing the CMS model. These companies may be suffering from lack of finances. Implementing the new model without the introduction of the cleaner production solutions or pollution abatement measures may weaken the success of the model.

4.3 Summary

From the last section we can summarize the list of advantages and barriers for CMS in Egypt.

Table 4-1 Expected advantages and barriers for CMS implementation in the Egyptian industries.

For....	Advantages	Barriers
Services providers	<ul style="list-style-type: none"> ➤ Improvement of chemicals used ➤ Improved relations with customers ➤ Decreased complaints from customers ➤ Attracting other customers ➤ Improved environmental image ➤ Taking the lead 	<ul style="list-style-type: none"> ➤ “Selling more” mindset ➤ Hard to understand the concept ➤ Absence of financial incentives ➤ Volume and type of chemicals should be suitable ➤ Risk of losing customers ➤ Lack of trust from the customers ➤ Weak competition
Services customers	<ul style="list-style-type: none"> ➤ Introducing cleaner production and reaching maximum efficiency ➤ Costs saving ➤ Understanding the real cost of chemicals management ➤ Use of fewer supplier ➤ Outsourcing model ➤ Improved relations with providers ➤ Improved data management and software usage ➤ Assured quality ➤ Focus on the core business ➤ Transfer to other processes in the factory ➤ Support of authorities 	<ul style="list-style-type: none"> ➤ Hard to understand the concept ➤ Fear of losing the control over the processes ➤ Multi-management problems ➤ Limited number of providers ➤ Customers can do it better than providers “sometimes” ➤ Financial problems

5. Analysis

Whereas Chemical Management Services model in Egypt is a very new business model, it is an old and mature model in the US and Europe. This study has identified different types of models used in Egyptian industry that are similar to CMS, but are not called CMS. Also the study has investigated the types of benefits and barriers that the implementation of the CMS model in the Egyptian Market can bring about and face.

The following section provides and discusses the result of a comparison between the benefits and barriers in Egypt and the benefits and barriers in the US and Europe. The case of Egypt can be adopted for other developing countries that have similar economical, social and environmental situation.

5.1 Advantages for services providers

Whereas service providers in Europe are major multinational companies, in Egypt large multinational companies play an effective role as service providers in addition to national companies. In Egypt the number of medium size chemical producing companies in new industrial cities is increasing, giving an indication of promising first tier service providers. The new service providers in Egypt have a unique opportunity to take the lead and to be “early followers” in implementing structured CMS models. In the Egyptian market, which likes mimicking, “being the first is half of the success”. First implementers have the chance to formulate the model according to their interests and abilities.

In Europe and the US, CMS encourages the service providers to develop their services and products using the latest R&D results. Similarly, in Egypt the adoption of CMS encourages the companies to develop services and products, to satisfy the customers’ expectations and to provide improvement “added value” ideas to customers’ products and processes. Nationally, the development is based on the companies’ efforts “only”. Unfortunately R&D is not advanced in developing countries, especially in Africa. The following table shows the geographic distribution of (R&D) foreign affiliate in 2004.⁹¹

⁹¹ United Nations Conference On Trade And Development. (2005). Globalization Of R&D and Developing countries: Proceedings of the Expert Meeting Geneva. U.N. New York and Geneva, 24-26 January 2005

Table 5-1 Geographic distribution of (R&D) foreign affiliate in 2004

Region /Economy	Number
Total world	2,584
Developed countries	2,185
<i>of which</i> Western Europe	1387
United States	552
Japan	29
Developing countries	264
<i>of which</i> Africa	4
Latin America and Caribbean	40
Asia	216
South, East and South-East Asia	207

I.e. Total numbers in red column is the number of companies. Other numbers include branches.

CMS decreases the customers' complaints but not liabilities, since relations between companies in Egypt are not based on strong and clear roles. Conversely, in Europe and the US relations between companies occur on a strict basis with clear responsibilities. This leads to decreased liabilities, which is not the case in Egypt.

In Europe and the US, competition between service providers is aggressive. CMS improves the competition position between the providers. In Egypt, low competition between providers leads to a lower importance of CMS than in Europe and the US. However, increasing competition is expected with the increase of the number of service providers in the market in addition to market reformations.

Generally, the advantages of implementing the CMS for service providers in Egypt and Europe and the US are similar - taking into account certain deviations in the Egyptian market due to the following five main reasons:

- *Immaturity of market*
- *Low R&D*
- *Vague relations between companies*
- *Low competition between services provider*
- *Leadership opportunity*

Table 5-2 Advantages for service providers to implement CMS in the Egypt, Europe and the US.

Advantages for services providers	
EGYPT	<ul style="list-style-type: none"> ➤ Improvement of chemicals used ➤ Improve the relations with customers ➤ Decreased complains from customers ➤ Attracting other customers ➤ Improved environmental image ➤ Taking the lead
EUROPE & the US	<ul style="list-style-type: none"> ➤ Enhanced relations with service receiver and increase mutual trust. ➤ Financial benefits and preventing price underbidding ➤ Ensured growth in business, through introducing adding value products and especially services. ➤ Increased competitive position ➤ Encourage R&D, and continuous improvement of products and services ➤ Winning the loyalty and trust of customers

5.2 Advantages for CMS customers

Generally for customers worldwide the main advantages of CMS are costs reduction, assured quality, improved relations with fewer providers and updated information management in the industrial entity. Costs reduction arises from decreased liabilities, savings in raw materials, realisation of the real cost of chemical management which allows the company to reduce total management costs. Assuring quality can be achieved when companies focus on the core business and continual improvement of processes, products and services.

Industries in Egypt are ready to adopt cleaner production practices, which give low or no cost improvement option. The support of service providers to implement cleaner production for the customers gives high credibility to the CMS model. On the other hand, industries in Europe and the US are usually more “green” due to strict regulation and strong enforcement. They are looking for the “cleanest production” options.

Support of the local authorities in Egypt (like EEAA and the Ministry of Trade and Industry) to increase exports using different tools like encouraging chemical management, business improvement and financial reformation, can be used by customers for implementing CMS. In Europe, adoption of CMS helps the industries to follow the new EU regulatory framework for the Registration, Evaluation and Authorisation of Chemicals (REACH). CMS promotes closer relationships between the supplier and the customer which is essential for the flow of information in the chemical supply chain needed for REACH. Similarly in the US, the Environmental Protection Agency (EPA) is funding a CMS evaluation program in several colleges and universities.⁹²

CMS allows reliable compiling and gathering of data in the customer facilities. Such data is essential for self-monitoring, authority requirement and ISO 14000 requirements. Both in Egypt and Europe and the US, CMS facilitates data management and chemical tracking during the life cycle of chemicals.

No major deviation can be found between advantages of implanting CMS in Egypt and Europe & US.

⁹² US EPA web site - Waste minimization. Found at: <http://www.epa.gov/minimize/cms.htm> . August 2006

Table 5-3 Advantages for services customers to implement CMS in Egypt, Europe and the US.

Advantages for services customers	
EGYPT	<ul style="list-style-type: none"> ➤ Introducing cleaner production and reaching maximum efficiency ➤ Costs saving ➤ Understanding the real cost of chemicals management ➤ Use of fewer providers ➤ Outsourcing model ➤ Improved relations with providers ➤ Improved data management and soft-wear usage ➤ Assured quality ➤ Focus on the core business ➤ Transfer to other processes in the factory ➤ Support of authorities
EUROPE & the US	<ul style="list-style-type: none"> ➤ Enhanced relations with service providers and increased mutual trust. ➤ Better control and management of chemicals and processes ➤ Realized real cost of chemicals and chemical management ➤ Reduced chemical consumption and therefore cost of chemicals ➤ Decreased liability for chemicals management and final disposal ➤ Decreased emissions and amount of waste ➤ Reduced health and safety risks ➤ Better internal logistics for products and chemicals ➤ Reduced number of suppliers, leading to reduction of management costs ➤ Provision of updated data that can be used in voluntary environmental certificates. ➤ Continued improvement of processes, products and services. ➤ Support of authorities

5.3 Barriers for services providers

Interviews with providers in Egypt showed that they still have a strong “selling more” mindset. Targets set by the mother company or top managers are the main drivers of the company strategy. Due to the weak competition and financial pressure in the local market, they are not forced to think of other selling and marketing strategies. On the contrary, in Europe and the US competition between service providers is high, driving providers to create and use all tools, methods and strategies available, such as CMS to reserve and expand their market share.

The Egyptian providers consider shifting to the new model to be risky. Risks arise from the probability of losing customers already receiving free services now. In addition to that, lack of trust between both parties, providers and customers, is affecting the model implementation. On the other hand, European and American providers are ready to take “calculated risk” since they consider it part of a successful business.

In the US, few studies have been carried out on small and medium enterprises (SMEs) to find suitable ways to adopt CMS. One of the barriers found is the low amounts of chemicals used by SMEs. Likewise, in Egypt 95% of the industries are considered SMEs and are using low amounts of chemicals. For this, a suitable solution shall be found by providers that target industrial clusters. In Egypt, EEAA is implementing a clustering plan for industries, especially industries of similar types (tanneries and smelters).

The trust of European and American customers in relation to service providers is low. They trust their internal working teams more in developing methods suitable to the industry. Also, they try to preserve in-house competencies rather than implementing the CMS model. Likewise,

Egyptian customers try to increase staff awareness and build capacities of employees rather than adopting the model or to be involved with any providers in a certain contract connected to the production.

CMS services providers in Europe and the US are complaining from the lack of support at national and industrial association level. This is referring to large business markets and limited number of associations and organizations support CMS model in these large markets. On the other hand, minimal effective support from national associations and organizations in the smaller Egyptian market can make a difference in CMS model dissemination and support.

Barriers for service providers are the same in Egypt, Europe and the US. Slight differences in Egypt are:

- *Low competition between providers*
- *Possibility of losing customers – Fragile relations with customers*

Table 5-4 Barriers for service providers to implement CMS in Egypt, Europe and the US.

Barriers for services providers	
EGYPT	<ul style="list-style-type: none"> ➤ “Selling more” mindset ➤ Hard to understand the concept ➤ Absence of financial incentives ➤ Volume and type of chemicals should be suitable ➤ Risk of losing customers ➤ Lack of trust from the customers ➤ Weak competition
EUROPE & the US	<ul style="list-style-type: none"> ➤ Customers’ low awareness about CMS ➤ Customers try to preserve in-house competencies rather than implementing the model ➤ Customers’ weak awareness of total life cycle cost ➤ Lack of support at national and industry association levels ➤ Low trust of providers capabilities

5.4 Barriers for service customers

Service customers worldwide are facing similar barriers. Fear of losing the control over processes, integration with others, limited number of providers, high transition costs and high internal capabilities of customers to implement chemical management programs are the most common barriers.

For implementing a feasible CMS model in Egypt, it is necessary to implement CMS which includes the application or use stage. A cleaner production measure reduces costs and encourages companies to expand the successful cases. Unfortunately, most of the big public Egyptian industries are facing financial challenges in implementing CP, which affects the CMS implementation indirectly. On the contrary, most of the big industries in Europe and the US are not facing this problem.

In the US and Europe, some CMS providers are resisting changing their own business routines to suit the customers' needs. On the contrary, providers in Egypt are showing positive attitude towards modification of their own routines. Willingness to change is due to a strong need to

develop long-term business relations with recent customers. This positive attitude can not be taken for granted, “talking is some thing and applying is another thing”.

Under the umbrella of corporate social responsibility (CSR), the global compact strategy principle number three enforced the freedom of and the right to collective bargaining by labourers.⁹³ In Europe and the US the relationship between employee and employer is set by clear responsibilities and rights. Workers may resist the implementation of CMS, because of the interferences of the providers and possible changes of responsibilities associated with the new situation. Conversely, employees’ responsibilities and rights inside the Egyptian industries are vague. Conflict may usually appear at the managerial level between customers and providers.

The differences between barriers for customers in Egypt and in Europe and the US are:

- *Financial challenges to implement CP*
- *Weak CSR*
- *Lower transition costs (comparatively)*

Table 5-5 Barriers for service customers to implement CMS in Egypt, Europe and the US.

Barriers for services customers	
EGYPT	<ul style="list-style-type: none"> ➤ Hard to understand the concept ➤ Fear of losing control over the processes ➤ Multi-management problems ➤ Limited number of providers ➤ Customers can do it better than providers “sometimes” ➤ Financial problems
EUROPE & the US	<ul style="list-style-type: none"> ➤ Limited number of CMS providers ➤ Resistance of some CMS providers to change their own business routines to suit the customers' needs ➤ Integration & negotiation problem ➤ Loss of knowledge and control over chemicals ➤ Resistance from workers ➤ Overall transition costs are high ➤ Weak top management support

Collective barriers and benefits to implement CMS for service providers and customers are presented in section 5.5.

The Chemical Management Services business model is a new model in the Egyptian market. Analysing the advantages and barriers can lead us to an outline of how CMS can be successfully developed in the Egyptian market.

5.5 Summary

In the previous chapters, advantages and barriers for CMS implementation in Egypt, Europe and the US were presented and compared. The following table provides a summary of the advantages and barriers discussed in the previous chapters.

⁹³ Roberts Hanna. (2005). “*What Does CSR means*”. Presentation in International Institute for Industrial Environmental Economics. Lund -Sweden. September 2005

Table 5-6 Advantages and barriers for CMS implementation in Egypt, Europe and the US.

	For....	Advantages	Barriers
EGYPT	Services providers	<ul style="list-style-type: none"> ➤ Improvement of chemicals used ➤ Improve the relations with customers ➤ Decreased complains from customers ➤ Attracting other customers ➤ Improved environmental image ➤ Taking the lead 	<ul style="list-style-type: none"> ➤ “Selling more” mindset ➤ Hard to understand the concept ➤ Absence of financial incentives ➤ Volume and type of chemicals should be suitable ➤ Risk of losing customers ➤ Lack of trust from the customers ➤ Weak competition
	Services customers	<ul style="list-style-type: none"> ➤ Introducing cleaner production and reaching maximum efficiency ➤ Costs saving ➤ Understanding the real cost of chemicals management ➤ Use of fewer supplier ➤ Outsourcing model ➤ Improved relations with providers ➤ Improved data management and software usage ➤ Assured quality ➤ Focus on the core business ➤ Transfer to other processes in the factory ➤ Support of authorities 	<ul style="list-style-type: none"> ➤ Hard to understand the concept ➤ Fear of losing the control over the processes ➤ Multi-management problems ➤ Limited number of providers ➤ Customers can do it better than providers “sometimes” ➤ Financial problems
EUROPE & the US	Services providers	<ul style="list-style-type: none"> ➤ Enhanced relations with service receiver and increased mutual trust. ➤ Financial benefits and preventing price underbidding ➤ Ensured growth in business, through introducing adding value products and especially services. ➤ Increased competitive position ➤ Encourage R&D, and continuous improvement of products and services ➤ Winning the loyalty and trust of customers 	<ul style="list-style-type: none"> ➤ Customers low awareness about CMS ➤ Customers try to preserve in-house competencies rather than implementing the model ➤ Customers weak awareness of total life cycle cost ➤ Lack of support at national and industry association levels ➤ Low trust of providers capabilities
	Services customers	<ul style="list-style-type: none"> ➤ Enhanced relations with services provider and increase mutual trust. ➤ Better control and management of chemicals and processes ➤ Realized real costs of chemicals and chemical management ➤ Reduced chemical consumption and therefore cost of chemicals ➤ Decreased liability for chemicals management and final disposal ➤ Decreased emissions and amount of waste ➤ Reduced health and safety risks ➤ Better internal logistics for products and chemicals ➤ Reduced number of suppliers, leading to reduction of management costs ➤ Provision of updated data that can be used in voluntary environmental certificates. ➤ Continued improvement of processes, products and services. ➤ Support of Authorities 	<ul style="list-style-type: none"> ➤ Limited number of CMS providers ➤ Resistance of some CMS providers to change their own business routines to suit the customers' needs ➤ Integration & negotiation problem ➤ Loss of knowledge and control over chemicals ➤ Resistance from workers ➤ Overall transition costs are high ➤ Weak top management support

5.6 Discussion

A comparison of the advantages and barriers for implementing CMS in the Egyptian market, and in the European and American markets, leads to both similarities and deviation. Deviations are going to be discussed in this section. Deviations found in the Egyptian market were:

Table 5-7 Deviation between the Egyptian and the European and American barriers and advantages for implementing CMS.

	For	Deviation
Advantages	Services providers	<ul style="list-style-type: none"> ➤ <i>Immaturity of market</i> ➤ <i>Low R&D</i> ➤ <i>Vague relations between companies</i> ➤ <i>Low competition between services provider</i> ➤ <i>Leadership opportunity</i>
	Services Customers	No major deviation found
Barriers	Services Providers	<ul style="list-style-type: none"> ➤ <i>Low competition between providers</i> ➤ <i>Possibility of losing customers – Fragile relations with customers</i>
	Services Customers	<ul style="list-style-type: none"> ➤ <i>Financial challenges to implement CP</i> ➤ <i>Weak CSR</i> ➤ <i>Lower transition costs (comparatively)</i>

National companies are ready to adopt successful business ideas and models. Chemical Management Services model can be an attractive model to the Egyptian national companies if:

- Multi-national and international companies - CMS providers - in Egypt started the model and offered success stories.
- National companies - CMS customers - accepted the model and started implementation.

In the Egyptian market we can find that both aforementioned conditions need to be satisfied. International companies are starting CMS model, such as AkzoNobel, which is implementing CMS with two local companies. Also other old and experienced local providers like the Housman Company are providing CMS to other local customers. But still the concept is not known or accepted when it is presented to the relatively less experienced “junior” local companies - both CMS providers and customers. There are different reasons for that:

- The concept is very new
- It is not easy to introduce a new business model to the market
- Immaturity of the Egyptian market
- No solid case studies (national or international) presented to industries at industrial conferences.

In the American and European markets, CMS is a better known model to the national industries. The markets are mature and have several successful stories to present within their markets or to

the outsider markets. But it seems that implementing CMS is not a strategic plan for European and American providers. International service providers like DOW and Ciba are providing CMS in the US and Europe, but there remains no sign of them implementing CMS in Egypt in the near future. Only BASF (textile chemicals department) is starting a discussion for a new cooperation with the Egyptian National Cleaner Production Centre to implement a “Chemical leasing model”. Other international, multi-national and experienced local providers should start implementing CMS in the Egyptian market, taking the great opportunity to be one of the leaders.

One of the CMS benefits in Europe and the US is reducing risks, accidents and losses leading to reduced liabilities. That is because of the clear roles and responsibilities between providers and customers. Relations between Egyptian providers and customers are based on “a fragile mutual trust”. Not only this, but slow judicial system and some old bureaucratic procedures may lead to very long legal cases. Environmental law enforcement and ease of judicial procedures may lead to motivate companies to apply different strategies and models like CMS or to implement preventive measure, to avoid liabilities.

Competition in the European and American markets is high. Service providers are trying to win more market share without harming their financial position. They are trying to satisfy customers with “added value” ideas and products. These ideas and product should be “worth paying for”. Advanced research and development (R&D) departments in the providers’ facilities play an important part in attracting more customers and clients. For CMS providers, R&D can give:

- Solutions to existing problems
- Innovative ideas
- Developed ideas
- Continuous improvement.

Competition between providers in the Egyptian market is weak. Market share is “settled”; each provider knows his customers and his main focus is to keep his customer and market share. Exploring other customers in the market is not the first priority, but it is always the second one for chemical management providers.

The only way for the Egyptian providers to gain an additional share in the market is to discover new areas that no other provider has tried. Here the importance of R&D arises. New products and ideas open new chances for profitable business. As mentioned previously, in Europe and the US CMS model activates R&D in the provider facility. Unfortunately R&D is not advanced in developing countries, especially in Africa. For example, **only four** R&D foreign affiliates are represented in the whole of Africa in 2004! In Egypt chemical manufacturers do not have strong grounds to start a real R&D program. But starting implementing CMS in the market can drive CMS providers to develop their R&D system. Most of the Egyptian industries are “short vision producers”. They are looking for the production of a certain product used nowadays without looking for the effective development of the product and its uses. International companies in Europe and the US have long-term plans and product lists. In Europe and the US it is normal to hear statements like “We are looking to introduce the next generation of our product by the year 2008”. This is because of effective R&D departments in the international companies. Greater attention to the R&D department is needed in the Egyptian industries.

EEAA and the Ministry of Trade and Industry are promoting chemical management via several programs such as the “Chemical leasing” program and chemical management raising awareness programs. But the “industry to industry” support is insufficient and needs to be strengthened. Industries (customers) themselves and industrial affiliates are the strongest players in this model.

Without the acceptance, approval and cooperation of the customers, CMS is not going to be implemented in Egypt. The picture in Europe and the US is much “brighter”. The authorities offer strong support through different frameworks and policies like REACH in the EU, and CMS evaluation programs in several colleges and universities funded by Environmental Protection Agency (EPA) in the US. In addition, different organizations like Chemical Strategies Partnership (CSP) in the US and Green Alliance in Europe are playing an effective “industry to industry” strengthening role. More efforts should be made by the Egyptian authorities and industrial affiliates. Since the National Cleaner Production Centre started with some efforts to implement CMS, evaluation of these efforts should occur and continuous improvement should be enacted through constructive cooperation between the Centre and EEAA, industrial affiliates and industries.

In the Egyptian market, most of the shareholders and company owners would like their facility to sell more, since selling more “benefits more”. Of course, this concept is famous in immature markets. In mature markets, like the US and Europe, selling more does not mean getting higher profits *per se*. That is because there might be entailed expenses and hidden losses from other activities. Egyptian industries should use the benefits of CMS adoption to know and understand the real costs of chemicals used and to avoid hidden causes of losses during chemical management. Awareness tools should be used with practical “financially feasible” success stories being presented to companies.

Some national service providers are offering chemical management service for free. Of course they are not losing, since they add the benefit margin to the costs of chemicals sold. The providers claim that they cannot charge their client for the services they used to give for free. “*We will lose our customers immediately*” they added. Comparing these ideas with the old ideas of service providers in Europe, we will find a lot of similarities. Dow Company in Europe used to provide services for free before the start of CMS programs. Egyptian providers should provide customers with the real cost of chemicals they pay for. And then they should use the flexibility of CMS contracts to design a suitable contract that provides attraction points like financial savings and environmental complying. Extra charges or negotiation for a new type of relationship between providers and customers can then take place.

Due to differing financial and social conditions in Europe and the US and Egypt, different transaction costs arise when applying the CMS model. A number of kinds of transaction costs have been identified:

- *Search and information costs* are costs such as those incurred in determining that the required good is available on the market, who has the lowest price, etc.
- *Bargaining costs* are the costs required to come to an acceptable agreement with the other party to the transaction, drawing up an appropriate contract and so on.
- *Policing and enforcement costs* are the costs of making sure the other party sticks to the terms of the contract, and taking appropriate action (often through the legal system) if this turns out not to be the case.

Comparatively, Egyptian transaction costs are much lower than the European and American equivalents. For example, direct bargaining costs in the Egyptian market are mainly internal: “Providers and customers are within Egypt”. Terms of contracts negotiation can take time, but will not consume much money, taking into consideration that the value of time in developing countries is lower than the developed countries. In Europe and the US negotiation tools like strong strategic background, data, CMS knowledge and experience may not vary that much between parties. But external (between the states or EU countries) negotiation, in addition to the internal bargaining costs, leads to more expensive transaction costs in Europe and the US.

Customers' employees are the ones who implement CMS in most of the cases, especially in the processing steps. In Europe and the US, employees are trained and educated to the levels that allow them to make total evaluation and give certain suggestions in issues related to their work. When implementing a new model like CMS in a developing country facility, workers have the right to accept or resist the model. There are labour right regulations in the Egyptian laws. But unfortunately, workers are not educated and awarded enough authority to make changes inside their facility. It is always the management's decision. Maybe it is a negative point from the SCR point of view, but it is certainly positive for implementing CMS without adding further obstacles from the employees.

In some cases, Egyptian customers showed negative attitude towards uncontrolled interfering in their operations by providers. One company claimed that providers are asking for too many changes and optimization in processes is beyond their financial means. CMS allows continual negotiation to find out "who will do what". Even this kind of negotiation can lead to widening the contract between the two parties to include process modification and cleaner production measure implementation. So it is expected after a certain period of time and wider dissemination of the CMS model in the Egyptian market that a stronger trust and suitable contracts, in addition to more constructive negotiations between providers and customers, are going to take place on the basis of the mutually beneficial, "win-win" conditions. In addition to this, CP can be used as a vehicle to disseminate CMS. Nowadays "Cleaner Production" practices are being implemented among the Egyptian industries.

As shown in figure 2-2, Chemical Management Services contracts especially in the use or application step may include:

- Monitoring and Controlling
- Use reduction initiatives
- Substitute or eliminate chemicals
- Product and process engineering.

Also it was found that customers in the US consider the application step the most profitable step in the CMS model. Likewise cleaner production (CP)⁹⁴ may be achieved in:⁹⁵

Processes by:

- Conservation of raw materials, water and energy (natural resources)
- Reduction in the use of hazardous materials
- Reduction in the amount and potential toxic effects of all emissions (into air and water) and wastes

Product by:

- The reduction of any negative impacts along the whole life cycle of the product, from the first raw materials and resources utilization up to its final disposal.

⁹⁴ Cleaner Production is the continuous application of an integrated preventive environmental strategy applied to processes, products, and services to increase overall efficiency and reduce risks to humans and the environment. (UNEP)

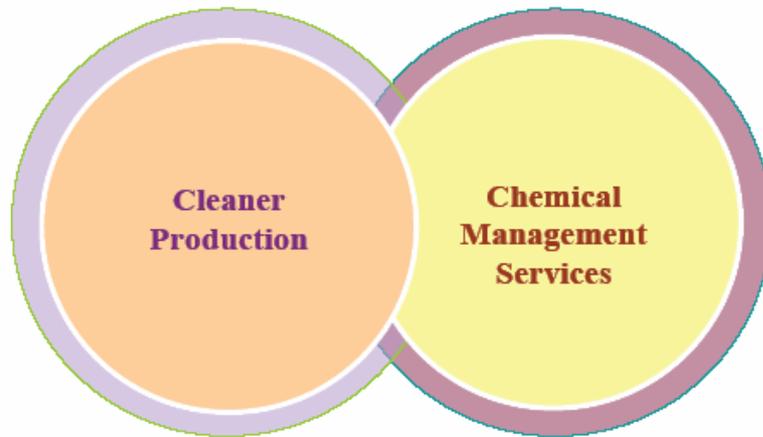
⁹⁵ DI Wolfgang Weissel .(2006). What means about Cleaner Production? A brief introduction to "Learn More about Less". UNIDO capacity building workshop on pollution prevention for the ENCPC, Organized by UNIDO Headquarter Vienna and the ENCPC. 13-17 August 2006.

Services by:

- The incorporation of environmental concerns into the design and the rendering of services.

Taking a close look at the two concepts, we will find similarities in the objectives. This similarity can cause confusion as to which one of them was responsible for the success. On the other hand, regardless of the concept adopted (CP or CMS) the main environmental and financial benefits will be obtained by the companies.

Figure 5-1 CP and CMS overlap in using or application step



From the author's perspective, this vague area shall not be cleared in this stage of implementing the model in Egypt: "haziness is useful sometimes". The main reasons are:

- Higher awareness of cleaner production concept in different levels, officially and industrially.
- Cleaner production is enforced by the National authorities (EEAA). A recent modification on the procedure and requirement of the Environmental Impact Assessment (EIA) requires the companies to take the cleaner production concept during the initial studies.
- Cleaner production can be used as a vehicle to introduce CMS.

Europe and the US are usually more "green" due to strict regulation and strong enforcement. They are looking for what can be called "cleanest production" options, which are looking farther ahead to an integrated pollution prevention including total life cycle assessment and product redesign & eco-design.

For companies adopting the environmental management system (EMS), CMS can be used as one of the tools for chemicals management. EMS can be implemented in the different stages of the chemicals management life cycle the same as CMS. As mentioned before, CMS helps in data management and information organization, which is one of the EMS requirements. Another example is in the storing stage. CMS provides the potential of environmental, scientific and practical storing for raw materials and products. The author thinks that EMS can be used as a vehicle to deliver CMS in several industries.

6. Conclusions and further research

The CMS model is one of the more promising business models in the Egyptian market. It was found that, although it is not called CMS, some cases in textile, petroleum and industrial wastewater treatment producers use models to some extent close to Chemical Management Service.

The comparative analysis between the advantages and barriers for implementing CMS in Egypt and in Europe and the US showed similarities and deviations. General similarities found are represented in the following table.

Table 6-1 Similarity between the Egyptian and the European and American barriers and advantages for implementing CMS.

	For....	Advantages	Barriers
EGYPT, EUROPE and the US	Services providers	<ul style="list-style-type: none"> ➤ Improvement of chemicals used ➤ Decreased complains from customers ➤ Improved environmental image ➤ Enhanced relations with service receiver and increased mutual trust. ➤ Financial benefits and preventing price underbidding ➤ Winning the loyalty and trust of customers 	<ul style="list-style-type: none"> ➤ Hard to understand the concept ➤ Volume and type of chemicals should be suitable ➤ Lack of trust between parties ➤ Customers' low awareness about CMS ➤ Customers try to preserve in-house competencies rather than implementing the model ➤ Customers' weak awareness of total life cycle cost
	Services customers	<ul style="list-style-type: none"> ➤ Costs saving ➤ Understanding the real cost of chemicals management ➤ Use of fewer suppliers ➤ Outsourcing model ➤ Improved relations with providers ➤ Improved data management and software usage ➤ Assured quality ➤ Focus on the core business ➤ Transfer to other processes in the factory ➤ Support of authorities ➤ Continued improvement of processes, products and services. ➤ Environmental improvement 	<ul style="list-style-type: none"> ➤ Hard to understand the concept ➤ Fear of losing the control over the processes ➤ Multi-management problems ➤ Limited number of providers ➤ Resistance of some CMS providers to change their own business routines to suit the customers' needs

Deviations in the Egyptian market include:

- *Immaturity of the Egyptian market*
- *Low R&D*
- *Low competition between providers*
- *Leadership opportunity*
- *Possibility of losing customers (fragile and vague relations between providers and customers)*
- *Financial challenges to implement CP for customers*
- *Weak CSR*
- *Lower transition costs (comparatively with the US and Europe)*

New promising opportunities were identified during this thesis. Opportunities can be found in textiles (dyeing and printing), carbonated beverages and breweries (bottle washing and CO₂ production), plastic manufacturing (polymer additives), water treatment (boiler water treatment and industrial wastewater treatment), paints industry (decorative paints), engineering industry (fabricated metals) and in the tanning industry (chemical treatment).

In the aforementioned examples, consumers and providers are fulfilling most of the criteria to implement successful CMS in the Egyptian market. For CMS customers there is environmental criteria (specialization chemicals, regulatory pressure, high consumption of chemicals), financial criteria (volume of chemical consumed, and chemical financial value), and facility criteria (large business, accepting the model). For providers there is the technical criteria (suitable customers for certain products), financial criteria (chemical sold or produced, market pressure), and the facility criteria (international or experienced local company, accept to adopt the model). Beyond this, there is the important presence of an independent third party during all the processes to build up the trust between CMS providers and consumers.

International, multinational and experienced local industries have great responsibilities to present, adopt and disseminate the model in the Egyptian market. Furthermore, cooperation between local authorities, business associations, industrial affiliates and industries should be strengthened.

Effective cooperation between Egyptian local authorities such as the EEAA and the Ministry of Trade and Industry, on the one hand, and international organizations and educational institutes like CSP in the US and the International Institute for Industrial Environmental Economics (IIIEE) in Lund University, Sweden, on the other hand. Both are looking for successful CMS in the global market aimed towards pollution prevention and sustainable development.

New communication channels and cooperation opportunities should be initiated through the presentation of success stories, and technical cooperation between local industries and international industries. This should motivate local entities to start adopting CMS model and shift from the "work as usual" mindset to a more "creative work" mindset.

There are different steps to implementing CMS in the Egyptian market. The main steps suggested are:

A. Inventory Step

Implement an inventory for the parties (current and expected service providers and customers) through a survey of the major chemical and service providers and to the expected customers in the market.

By using the international experience and successful case studies, preliminary cases in a suitable industry can be chosen.

B. Industry viability determination

The viability of parties nominated to implement the model should be determined. The criteria of CMS viability within an industry can be done by detecting all or part of the following criteria:

- Environmental and Technical criteria
- Financial criteria
- Facility criteria

C. Selection of companies

It is recommended to start with big national or joint venture suppliers and with international companies having experience of implementing CMS outside Egypt.

D. Clarifications

Intensive meeting and events shall be launched for the clarification of the concept of the new model to the selected providers and customers by professionals. Also benefits, barriers and expected threats should be identified and declared.

E. Contracting

Selection of the contracting type should be made on case by case basis. The presences of fixable and different contract types facilitate the implementation. After selecting the suitable contract, a detailed negotiation for setting the roles and responsibilities of the different parties should take place. The contract should be tightened (minimal gaps).

F. Financial and technical support

For the first couple of companies in each sector, financial and technical support should be provided for free. Financial support may cover first optimization and modification before implementing the model. Technical support before and during implementing the model is needed too. Support may cover the risks of the model failure in some sectors.

G. Processes optimization

If the model will include the application step (production), optimization and tuning the processes should be done. Introduction of the cleaner production concept and optimization of the processes allow accurate and absolute calculation of the benefits of the model.

H. Implementation

Implement CMS model that includes the application step, since it is the most profitable for the customers. It is usually financially profitable also for the providers in the profit sharing contracts.

I. Control

Presence of third “Nature-independent” party is important especially in the negotiation, contracting and implementation of the model. This third party may offer the financial and technical assistance. It also works as a “judge” in case of problems.

J. Promotion

Promote the model and introduce financial support to implement the model at the start to attract more companies taking advantage of “mimicking”. Egyptian industry likes repetition of successful cases especially if they are new and innovative.

Further research is needed for implementing CMS in the Egyptian SMEs and in educational institutes. Small and medium enterprises (SMEs) represent more than 95% of the industries in Egypt. They are defined according to their number of employees or annual sales or capital cost. In the US, a study by Illinois State University presented the benefits and barriers facing the implementing of CMS in American SMEs. Due to the differences between American and Egyptian SMEs, in terms of number and categorization, legal, financial, institutional and technical statuses, a special study should be implemented *specifically* for the Egyptian market.

In the US, there are several successful cases of implementing CMS in educational institutes. From the lessons learned from the American successful stories, CMS helps the educational institutes in development betters chemicals management in laboratories. In Egypt, educational

development is one of the government priorities. Chemical management services can play a role in this target. Implementing CMS model can reduce costs of chemical management which allow the educational institutes to relocate expenses for other issues. Risk reduction can be achieved as an additional benefit.

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Yusry Thabet. (2006). El Ahram Beverages Company, Sharqya Plant-Utilities Manger. *Personal Meeting*. July 2006.

Abbreviations

BATNEEC	Best Available Technologies Not Entailing Excessive Costs
ChL.	Chemical Leasing
CMS	Chemical Management Services
CP	Cleaner Production
CSP	Chemical Strategies Partnership
CSR	Corporate Social Responsibilities
EEAA	Egyptian Environmental Affairs Agency
EHS	Environment, Health and Safety
EMS	Environment Management System
EPA	Environmental Protection Agency
GDP	Gross Domestic Product
IWWTP	Industrial Waste Water treatment Plant
MSDS	Material Safety Data Sheet
PSS	Product-Service Systems
REACH	Registration, Evaluation and Authorisation of Chemicals
SHE	Safety, Health and Environment
SMEs	Small and Medium Enterprises
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar

Appendix (1): Officials, consultants and NGOs interviews during the thesis

Interviews	
Egyptian Environmental Affairs Agency - EEAA	
<ul style="list-style-type: none"> • Gen. Ahmed Hegazy – The Deputy Minister for Industrial Affairs • EEAA legal and inspection departments • EEAA hazardous material department 	
Industrial Modernization Centre	
<ul style="list-style-type: none"> • Information Centre 	
Selected Major consultancy companies in Egypt	
<ul style="list-style-type: none"> • EWATEC: Dr. Samia Massoud • Dorsch Consult: Keith Brook 	
The National Cleaner Production centre	
<ul style="list-style-type: none"> • Eng. Hanan El Hadary – Director • Chem. Ali Abu Sena - Chemical leasing National consultant 	
Selected non-governmental organization (NGO)	
<ul style="list-style-type: none"> • Friends of the Environment Association in Alexandria – FOEA 	
The selected companies employees	
Related companies	
Directors or responsible - upon results of research:	
<ul style="list-style-type: none"> ➤ Egyptian Petrochemicals ➤ Sedi Krer Petrochemicals ➤ Midom services company ➤ Hesny Group ➤ Egyptian Salt and Soda ➤ Normidas textile company ➤ Misr El Hegaz Plastic Co. ➤ El Mansura resins Co. ➤ Alexandria Carbon Black Co. ➤ Tanta Oil and Soap ➤ Arma Oil and Soap ➤ New Cairo Poultry Company ➤ Dr. Olivee Agricultural services 	<ul style="list-style-type: none"> ➤ Misr Amria Spinning and weaving ➤ AkzoNoel ➤ GM ➤ Zinc Misr ➤ Houseman Egypt ➤ BASF ➤ Al Ahram Beverages ➤ QuikTel ➤ Metito Egypt ➤ Nile Pharmaceutical ➤ DOW Egypt ➤ Ciba ➤ NIJHIS Water Technology Egypt Limited

Appendix (2): Companies visited and interviewed during the thesis

	Companies	Contact person	Position
1	Midom services company	Hamdan Nour El Din	Vice director
2	Egyptian Petrochemicals	Mohsen Zaher	Chairman
3	BASF	Waleed Nasr	Paints division - Senior sales manger
4	Al Ahram Beverages	Yusry Thabet	Sharqya Plant-Utilities Manger
5	QuikTel	---	---
6	Metito Egypt	Amr Azam	Senior sales Engineer
7	Ciba	Alla Othman	Huntsman advanced Material Specialty Chemicals (Ciba) - sales representative
8	DOW Egypt	Salah Marwan	Dow Egypt. Factory general manager
9	Nile Pharmaceutical	---	---
10	Misr Amria Spinnign and weaving	Mohamed Amin	Engineering department. GM
11	Dr. Olivee Agricultural services	Ahmad Shehata	Employees' affairs manager and environmental department director.
12	Akzo Nobel	Mark Reekie Ashraf El Wassify	Akzo Nobel Business Service Manger – Europe Akzo Nobel Egypt – Technical Manger, Deputy general manager
13	General Motors	Ali Hasan	Paint process and environmental manager
14	New Cairo Poultry Company	Adel El Alfi	Deputy General Manager for Industrial Operations
15	Alexandria Carbon Black Co.	K. N. Agrawal	Managing Director
16	El Mansura resins Co.	H. K. AGARWAL	Vice general manager
17	Misr El Hegaz Plastic Co.	Husam Abdul Rahman	Plastic Manufacturing expert and production manger
18	Normidas textile company	----	---
19	Zinc Misr	Basem Nagy.	General Manager
20	Houseman Egypt	Amin M.A. Ramadan Ahmad Ramadan	Managing director. Deputy managing director
21	Sedi Krer Petrochemicals	---	---
22	Egyptian Salt and Soda	Samia Zain El Din	Chairman
23	Hesny Group	Alla Tawfik	Hesny Group Environmental Manager
24	Tanta Oil and Soap Co.	Nabila Hamouda	Engineering department manager
25	Arma Oil and Soap Co.	Abdul Maseeh Seha	Fire and Safety department general manager
26	NIJHIS Water Technology Egypt Limited	Samia Othman	Engineering department general manager