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Information Technology, A Challenge to Chemical Process Industry and Lamar University

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Abstract

The chemical process industry (CPI) is facing the challenge of global competition. This challenge, however, creates opportunities for CPI to consider better technology solutions and to improve plant operations by using information technology (IT). Lamar University, located at the center of the petroleum refinery and petrochemical industry in the United States, is hosting a seminar series, "Information Technology, A Challenge to Chemical Process Industry", with one seminar every two months throughout 2001. These seminars, emphasizing the operation, maintenance, and safety of CPI, bring together three distinct groups: IT solution providers, CPI, and academia, to explore the use of IT in CPI. This paper is to share both our experience in organizing this series and some preliminary results.

1. Introduction

The U.S. chemical process industry (CPI) is the world's largest producer of chemicals (value shipped: $367.5 billion in 1995), contributing the largest trade surplus of any non-defense-related sector to the U.S. economy, representing 10 percent of all U.S. manufacturing, and employing more than 1 million Americans [1]. The CPI faces three challenges: (1) competing globally while meeting the stringent U.S. environmental and safety regulations, (2) transition issues of turning years of paper-based operation into information technology (IT) age, and (3) the current MAD (merge, acquisition, and divesting) syndrome, which causes a rapid bottom-up response. These challenges, however, create opportunities for the CPI to look into better technology solutions and improve plant operations by using IT for better communication both inside and outside the plant.

Lamar University (LU) is located at the center of Spindletop, which was the site of the first gusher in Texas (in 1901) and, hence, where the petroleum refining and petrochemical industry in the United States began. LU, having enjoyed a close relationship with the petroleum refinery and petrochemical industry during the past seventy-five years, feels the pressure of this challenge of global competition too. Therefore, we want to participate and learn with the CPI so that we can educate our engineering students to meet the challenge.

A seminar series entitled "Information Technology, A Challenge in Chemical Process Industry" was organized under the Industrial Infrastructure Committee of the Engineering Advisory Council at LU. LU is fortunate to have this Advisory Council consisting of industry leaders who run companies with global operations and share their up-to-date information on the business environment with LU.

2. CPI today

Any CPI owner today is really in global environment from the supply chain or service chain point of view. Moreover, the CPI is facing global competition, re-aligning of relationships due to mergers and acquisitions, technological advances in IT, as well as stringent regulatory compliance in HES (health, environmental, and safety). Though CPI plays a major role in advancing the standard of living in the US, CPI's image is at an all-time low [2].

CPI is working hard to adapt IT into their operation; however, the culture gap between "paper based" and "IT based" is huge. Furthermore, the lack of readiness of their personnel and their traditional mind-set in operation hinder the process and speed of adaptation. As the personnel are used to using old,

time-consuming procedures to perform various daily functions, these procedures are not being transformed into an IT environment.

Since CPI is not going to disappear soon, the challenge is for academic institutions to learn CPI today to be in a position to train future CPI leaders. LU is committed to take this challenge.

3. Supply chain management (SCM 1) and Service chain management (SCM2)

The concepts of supply chain management (SCM1) and service chain management (SCM2) have been recognized very well in CPI. The CPI needs to manage both SCM1 and SCM2 optimally to stay in business. In reality, SCM1 is CPI's core business while SCM2 is supported by service chains, as can be visualized from a conceptual diagram shown in Figure 1. CPI and their service chains are very much interwoven. At this moment infrastructure to support common issues under SCM1 and SCM2 is still in a transition stage under the IT environment.

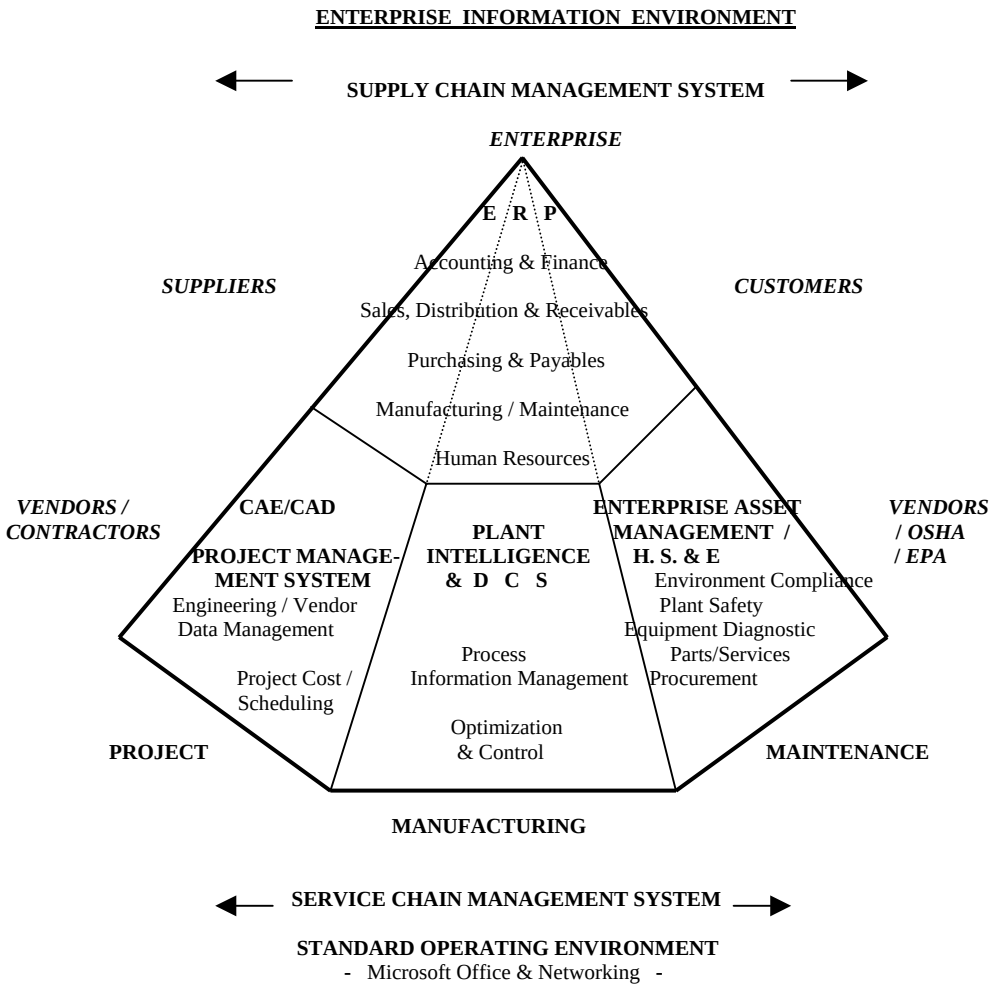

Figure 1. CPI enterprise information environment (S.H. Lee [3])

Because SCM2 is supported by various suppliers, it is very complex to achieve “seamless” service. It takes good efforts. These suppliers may include licensors, Engineering and Construction (E&C) firms, equipment vendors, construction and maintenance firms, as well as software or hardware providers and integrators.

SCM2 can be divided into four categories: (1) Enterprise Solution, (2) E&C Solution, (3) Simulation & Optimization Solution, and (4) Operation, Maintenance, and Safety (OMS) Solution. With these four pillars of supports, CPI can maximize uptime and minimize non-compliance in the life cycle of their plants. Management of SCM2 effectively is a real challenge.

4. OMS

OMS Solution by its nature provides plant managers with a grasp of both their daily and hourly needs. As one of the four pillars, OMS imports extensive data/information from E&C Solution while interfacing with Simulation & Optimization Solution during life cycle O/M stage. The communication between OMS and Enterprise Solution allows global CPI operation on a “consistent basis”. So, obviously, OMS Solution enables plant-site operation, maintenance, and HES personnel to enjoy better communication through a common platform and results in better return on investment for CPI. Lamar’s Industrial Infrastructure Committee of Engineering Advisory Council has targeted OMS Solution as the goal of our seminar series. The topics of this seminar series are shown in Table 1.

Table 1. Topics of the seminar series "Information Technology, A Challenge in CPI"

1. OMS Basics - Asset Linking Technology (ALT) using MocKingbird® Tool
2. OMS Within A Big Picture - Design and Operation Life Cycle Information Platform
3. OMS Fine-Tuning
4. OMS Extension – Vendor City and Technical Library
5. OMS Infrastructure for Life Cycle
6. Life Cycle Issue with Solution Providers: Software and Hardware

No OMS Solution exists today under IT environment. In fact, under current U.S. CPI operation, only O/M are operated closely while HES groups are working nearly independently. This situation can be improved through IT infrastructure. However, CPI faces scattered sets of OMS packages from various service providers that are incompatible and hard to integrate.

5. Where to start

From safety and reliability points of views, one industry in Lamar’s neighborhood, NASA, is very outstanding. As Lamar has become an incubator for NASA technology transfer to CPI, we have included NASA’s approach in our endeavor (OMS Solution) through one of NASA’s service providers. NASA’s “Failures are not an Option” slogan implies their integrity in design and operation as well as subsequent maintenance. NASA technology encompasses control, command, communication and computer & information applications. We consider NASA technology provides good reference for system integration as well as life cycle care issues for IT systems.

In contrast to NASA, CPI has, for years, compromised their requirements on SCM1 as well as SCM2. This compromise has accumulated into current complex issues on compliance and image enhancement of CPI. We need to address the basic design, construct, operation and maintenance and their integration challenge. Since current SCM2 is vaguely defined and loosely connected, issues under SCM2 are the common problems to CPI. It takes common solution to tackle the problems.

6. Opening Remark from CPI

Mr. Dan Smith, the CEO of Lyondell-Equistar, has addressed the importance of IT in CPI in his opening remark for this seminar series. His outstanding remarks are shown below.

" Often, information technology can be an important tool that differentiates one company from another in how successfully it handles and profits from these changes.

It is critical to the success of our organizations that information and training quickly and smoothly flow through the organization. One way we can do this is by very quickly rationalizing inherited I.T. legacy systems from various components of the company into one working system.

By making this change swiftly and completely, we can more quickly capture synergies throughout our entire supply chain and better manage the information flow throughout the organization.

The key is connectivity of information – which links the supply chain from production, customers and suppliers. This means putting systems in place to ensure that information is widely available inside the company, as well as outside the company, with proper restrictions, and that the data is consistent and available on a real-time basis. To achieve these goals leads you to one data system – one set of data.

This helps remove confusion and allows the organization to quickly capture knowledge, exchange information and facilitate all aspects of its operations. A properly equipped “work bench” becomes a very valuable catalyst for change and improvement.

This seminar is a key step in this process – enabling people with relevant core competencies to look at solutions that are being designed and put into place to facilitate smooth legacy transitions, increase efficiencies and increase profitability."

7. The first three seminars

Though our seminar series is now only half way through, we have achieved the intended objectives of articulating the needs of OMS by working together with presenters and participants in the seminars and receiving feedback from the surrounding CPI plant management.

In the first seminar, the presenter shared his companies’ experiences in setup and training of an Asset Linking Technology (ALT) in Lyondell - Equistar [4]. Assets represent years of accumulated knowledge, practices, and procedures that can be linked together without sacrifice their current roles in plant operation. ALT allows plant personnel to access information with their own pace and need, thus creating a true knowledge based workers. ALT also provides plant-site OMS personnel with freedom of collaboration among themselves and other disciplines within plant-sites.

During the second seminar, the presenter shared Intergraph’s vision "Design and Operation Life Cycle Information Platform" [5]. Intergraph is working with proven solution providers to develop a prototype for life cycle operation supported by a data warehouse. This prototype will provide cost-effective solutions for plant life cycle OMS.

The third seminar concentrated on the usage of IT as environmental compliance solutions [6]. PDC (Process Data Control) Corporation has a successful consortium addressing EPA compliance solutions while EMS (Environmental Monitoring Service, Inc.) has demonstrated successfully an implementation of environmental software in the field. This seminar presented how both compliance solutions and the orderly transfer of data/information from plant design become an integral part of plant real-time operation and furthermore benefit the operation and maintenance personnel (OMS and Health-Safety-Environment integration).

8. Moving ahead

Lamar intends to focus on the issues under OMS and to establish an integrated OMS platform. By doing so, we respond to the current CPI needs. In addition, we can analyze and synthesize common problems within OMS and yield materials for the training of future CPI leaders in plant management. In 1901, Beaumont, Texas was recognized as the birthplace of the petrochemical industry. In 2001 under IT environment, Lamar University at Beaumont embarks into the task of articulating OMS Solution. With the fine-tuning of CPI operation under OMS platform, CPI can excel further. You can check into our progress through *http://hal.lamar.edu/%7Eche_dept/*

9. Special thanks

We are encouraged by the opening remark from Mr. Dan Smith, the CEO of Lyondell -Equistar. Equistar is the largest ethylene producer in the world where Mr. Smith takes a lead and challenge under MAD syndrome. We also acknowledge Mr. S.H. Lee's supply of Figure 1 in which Mr. Lee has planned and attempted to go beyond. Mr. Lee is still an active executive in CPI business where he has accumulated over 30 years experiences in a sizable E&C firm and an international CPI operation firm for engineering and IT functions.

10. References

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