



Imperial College
Centre for Process Systems Engineering
The Seventh
Professor Roger W.H. Sargent Lecture

Is There a Need for a New Process Systems Engineering?

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Thursday 30 November 2000, 17.30
Clare Lecture Theatre, Huxley Building

Abstract

Process Systems Engineering (PSE), as a term, has the fortunate distinction of implying either "The Engineering of Processing Systems", or "The Process of Systems Engineering". In the traditional use of the term among chemical engineers both interpretations have been used interchangeably, with the first defining the industrial scope of systematic engineering activities, while the second underlines the organized and methodological character of the engineering work that comes under the PSE heading.

Roger Sargent has the honorable distinction of being the biological, and arguably the titular, father of both interpretations. The breadth and depth of his own research work, the vast expanse of contributions by the many members of his academic tree have created, nourished, and expanded the horizons of what we today refer as the PSE. This is a remarkable accomplishment with a unique position in the history and present-day reality of chemical engineering.

As chemical engineering has been changing from a discipline focused on the engineering of bulk commodity chemicals producing processes, to one that addresses the engineering of a multitude of new types of products, questions have arisen as to whether PSE is still relevant in its established philosophy, methodological approaches, and specific set of techniques.

"Is there a need for a New Process Systems Engineering?" This is the question that I will try to answer.

What is probably the most distinguishing feature of the evolution of the chemical industry over the last 15-20 years is the shift from a "Process-Centered" focus to a "Products-Centered" one. In a Process-Centered industry the product is well known in advance and all the engineering work is focused on developing, designing and deploying the optimal process by; (a) selecting the appropriate raw materials, reaction pathways, catalysts, solvents and other processing materials, (b) configuring the structure of processing operations, and (c) ensuring safe and cost-effective operation of the process. PSE has made remarkable contributions in rationalizing the engineering activities of the Process-Centered chemical industry.

In a Products-Centered chemical industry, the product is not clearly known ahead of time, but it comes as a result of an intricate process which involves, (a) identification of market trends, (b) translation of these trends to product specifications, (c) design of products meeting these specifications, and (d) design of a manufacturing system that will produce the desired product. This process is not sequential but iterative in nature, and it gives rise to a formidable process, which requires the cooperation and interaction of market analysts, and a variety of scientists (chemists, physicists, biologists), and engineers (chemical, materials, mechanical, electrical).

Is the framework of the existing PSE appropriate for the Products-Centered chemical industry? There has been a lot of discussion within the PSE community on the need for systematic approaches to Product Design. This is a rather oversimplified reduction of a far more complex problem. The product design and the design of the associated

manufacturing system cannot be separated. In addition the design of the both is governed by an exploding richness of scientific knowledge, which defies the traditional scope of a chemical engineer.

However, the essentials of PSE are still applicable. In this presentation I will discuss some ideas on how it can be expanded to address the needs of a Products-Centered chemical industry, giving illustrations from a variety of new problems.

In the chair:

Professor Sandro Macchietto

Vote of thanks:

Professor David Bogle

ALL WELCOME