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J. Eng. Technol. Manage. 18 (2001) 241–252

Journal of
ENGINEERING AND
TECHNOLOGY
MANAGEMENT
JET-M

www.elsevier.com/locate/jengtecman

Sociotechnical systems in an age of mass customization

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Abstract

Sociotechnical systems theory (STS) emerged as a design tool for democratizing work in an age of mass production. How should STS be re-thought for the age of mass customization? Linking mass customization to the task of building a learning organization, this article examines the case of redesign of a chemical pilot plant whose purpose was to test new equipment and methods for producing new compounds. The redesign brought into sharp relief the ways in which the changing role of the operator and the primary task of learning, leads us to reconsider such basic STS concepts as “autonomy”, “variance control”, and the redundancy of function. We present a new set of concepts and argue that they are more responsive to the challenges of designing learning organizations. We also suggest that the concept of “meaning” should replace the idea of autonomy to express the moral meaning of STS. © 2001 Published by Elsevier Science B.V.

Keywords: STS; Mass customization; Learning organization; Autonomy

1. Introduction

1.1. *The three pillars*

Sociotechnical systems theory (STS) was a technical, moral and political discipline. Morally, it was based upon the idea that workers are entitled to working conditions that supported their all around competence and their relationships with work mates, politically it was grounded in the movement for industrial democracy, and technically it offered methods for designing work to minimize the errors or “variances”. These three elements sometimes shaped a contradictory practice. When management sponsored an STS design, it had no intention of relinquishing ultimate control of the plant to the workers. When STS practitioners and consultants helped redesign the plants, they often over-focused on variance analysis,

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and neglected the social psychological needs of workers for autonomy, collegiality and all around competence.

1.2. The impact of STS

STS's impact has been mixed. Japanese lean production methods, based in total quality management (TQM) and just-in-time (JIT) and the American-based business process re-engineering (BPR) have had a more pervasive impact on industrial engineering and plant design. Estimates suggests that after 50 years, STS-like innovations have reshaped only about 30% of manufacturing plants in Canada and the US. (Osterman, 1994; Betcherman et al., 1994). In response, STS practitioners have developed methods for streamlining the design process itself, but it is unclear if these new methods can accelerate the diffusion rate of STS innovations (Lytle, 1997). It is interesting to note that executives appear to favor BPR with its "top down–cost reduction" approach to change over STS and its more inclusive (in terms of participants and goals) approach. This despite the growing empirical evidence that STS designs pay-off (Macy, 1993), and complementary evidence that re-engineering's effects are spotty. Perhaps, as some have long argued, management's interest in retaining control outweighs its interest in effectiveness. Indeed, responding to this resistance, STS practitioners rarely make reference to the roots of their practice in industrial democracy.

1.3. Mass customization

One hypothesis that explains the limited diffusion of STS is that STS as a philosophy and practice is rooted in the economics of mass production, when the division between blue collar and white collar was hard and fast and companies made money by minimizing costs and using labor efficiently. In this setting, executives and owners worried that any technique even loosely associated with industrial democracy would raise costs and erase the boundary between workers and managers. However, automation, the success of lean production, STS and BPR have all changed the conditions of competition and effectiveness in the manufacturing sector. It is increasingly difficult for companies to sustain their competitive advantage by simply keeping labor costs low. Increasingly, labor is a fixed cost, control systems rather than workers keep production variances within bounds, and digital computers on the shopfloor give workers information on quality and cost that only managers once had. Workers, who were once controlled by management, take on a managerial role by controlling the controls (Hirschhorn, 1984).

In this setting, profitability is determined increasingly by the flexibility of the plant, that is the ease with which managers and workers can change the plant's configuration to produce new products. This new mode of competition becomes increasingly important as companies try to make money by producing high value-adding products designed for the use by a few customers. This process has been called "mass customization". In other words, looking back, it is now evident that STS matured in a culture of mass production, where semi-skilled workers deployed at work stations managed a workflow to produce a standard product. In the age of mass customization, managers gain less from minimizing labor costs and withholding information from the workers. The times may now be more

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