Creating and Transferring Knowledge for Productivity Improvement in Factories

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Can a firm accelerate its learning curve if knowledge about the production function is incomplete? This article identifies a production line specifically set up to create technological knowledge about its production function through scientific experimentation (formal learning) as opposed to learning by doing. The organizational structure of this line was very successful in creating technological knowledge. Formal learning resulted in huge productivity improvements. Replication of this organizational structure on three production lines in other plants within the same firm fell short of expectations. Formal learning did not result in similar productivity improvements. Our research suggests two factors that may facilitate creation and transfer of technological knowledge: management buy-in and knowledge diversity to solve interdepartmental problems.
(*Learning Curve; Total Factor Productivity; Learning by Doing; Formal Learning; Technological Knowledge; Knowledge Transfer; Replication*)

1. Introduction

Scholars have frequently studied the learning curve phenomenon. Managers have extensively used learning curves for planning purposes (Yelle 1979). Basically, the logarithm of unit cost decreases with the logarithm of cumulative number of units produced at a uniform rate—the learning rate. Learning rates, however, show considerable variation within industries, within firms, even within plants (Levy 1965, Hayes and Clark 1985). Drawing on more than 200 learning curve studies, Dutton and Thomas (1984) conclude that a learning rate should no longer be treated as a given constant based on past performance, but as a dependent variable influenced by a firm's behavior.

A disappointing managerial implication of the larger part of the learning curve literature is that the only way to speed up cost improvement is to speed up cumulative volume, which may not always be desirable nor feasible. Yet, experts have emphasized the competitive potential of learning rates. Some even argue that "the rate at which individuals and organizations learn may become the only sustainable competitive advantage" (Stata 1989). Consequently, we need to improve our understanding on how to manage learning curves. In particular, scholars have called for research on managerial levers that accelerate learning curves (see, e.g., Jaikumar and Bohn 1992).

Few studies have incorporated managerial variables in learning curve analyses. The ones that did focused on training and engineering activity to capture deliberate activities that aim to accelerate learning curves. Levy (1965) used direct labor training hours to explain different learning rates across workers in a cross-sectional study. Adler and Clark (1991) used longitudinal data on cumulative number of hours spent by workers on training and cumulative number of hours spent on engineering changes. Interestingly, the authors found that each managerial variable could enhance as well as disrupt total factor productivity. The learning process behind the

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