

The Nonstationary Staff-Planning Problem with Business Cycle and Learning Effects

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Managing highly skilled employees is extremely complex because of the need to balance the costs and time lags associated with their training against the need to meet demand as quickly as possible. Unlike previous approaches to this problem in the staffing literature, this paper develops an optimal staffing policy at the strategic level to cope with nonstationary stochastic demand for a staff characterized by unproductive apprentice employees and fully productive experienced employees. The paper then explores the implications of this policy in different industries, using empirical data. Aside from the optimal policy, this paper's primary results include: (1) demand volatility reduces average productivity, most especially under conditions of low (or slightly negative) growth and—nonintuitively—*low* employee turnover or knowledge obsolescence rates; (2) there is a trade-off between meeting demand and high productivity; (3) firms with *longer* business cycles should smooth their hiring and firing policies; and (4) firms in industries with longer training times should smooth their hiring and firing policies. The paper also explores the possible rewards from reducing training times and turnover rates. Finally, it discusses managerial implications and possible future directions in research.

(Staff Planning; Learning; Capacity Planning; Knowledge Management; Product Development; System Dynamics; Control Theory; Stochastic Dynamic Programming)

1. Motivation

In recent years, managing employee knowledge and skills has become a topic of ever increasing interest in the field of management research (Argote 1999, Davenport and Prusak 1997, Fujimoto 1994, Wernerfelt 1984). This interest should only intensify as the developed world moves from an industrial-based to a more service- and information-based economy, making industry ever more dependent upon the skills of its employees rather than the knowledge embodied in its capital and organizational procedures (Brooks 1982, Mills 1988). There is a great need for strategic models of efficiently managing the acquisition of employee knowledge and skills—that is, learning. The problem is quite complex because often much

of this knowledge is derived from formal training and, more importantly, informal mentoring during on-the-job training, which is paid for by firms rather than by the individual employee. Thus, during downturns managers face difficult questions. Should firms lay off highly skilled employees? Highly skilled employees are quite a drain on resources if they are not fully utilized. On the other hand, training their replacements during a future upturn may take a great deal of time. And, if the new apprentice employees require significant mentoring, hiring may quite possibly reduce capacity just when demand is increasing. During upturns, should firms hire in anticipation of the rosier scenario, or should they be more conservative? How much should a firm