

The Effects of Worker Learning, Forgetting, and Heterogeneity on Assembly Line Productivity

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The authors investigate through several simulations how patterns of learning and forgetting affect the operating performance of an assembly line. A unique aspect of this study is that a distribution of learning/forgetting behavior based on an empirical population of workers is used rather than assuming the same learning pattern for all employees. The paper demonstrates that modeling only central tendency and not the variations across workers tends to systematically underestimate overall productivity. The data used to estimate the parameters for the distribution of learning curves were collected from an assembly line that produces car radios.

Analysis of the models fit to a population of workers reveals that higher levels of previous experience are positively correlated with higher steady-state productivity levels and negatively correlated with the learning rate. To further motivate the study, a conceptual model with several factors hypothesized to influence assembly line productivity is presented. Among key factors included in the model are the rate of worker learning, the size of the worker pool, task tenure, and the magnitude of worker forgetting. In controlled computer simulation experiments, each of these factors was found to be statistically significant, as were a number of the two-way interaction terms.

(Learning; Forgetting; Worker Heterogeneity; Simulation)

1. Introduction

A variety of forces are simultaneously creating a new learning environment for shop floor workers. For example, many organizations are shifting from making a few products with long life cycles to managing product families with shrinking life cycles. At the same time, many of these organizations are accelerating their rate of process innovation and improvement, increasing worker flexibility through cross-training, and restructuring or reorganizing work activities. An important implication is that in this new

environment, the individual worker must constantly adapt to changing tasks.

Furthermore, as the frequency with which individual workers are required to master new tasks increases, the amount of time the workforce spends on the steep part of the learning curve increases as new products are introduced, as they are rotated to other jobs, and as their work is restructured (e.g., Uzumeri and Nembhard 1998, Uzumeri and Sander-son 1995, Brown and Duguid 1991). More specifically, in less dynamic environments workers have ample

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Handbook of Industrial and Systems Engineering, Second Edition Adedeji B. Badiru, 2013-10-11 A new edition of a bestselling industrial and systems engineering reference Handbook of Industrial and Systems Engineering Second Edition provides students researchers and practitioners with easy access to a wide range of industrial engineering tools and techniques in a concise format This edition expands the breadth and depth of coverage emphasizing new systems engineering tools techniques and models See What s New in the Second Edition Section covering safety reliability and quality Section on operations research queuing logistics and scheduling Expanded appendix to include conversion factors and engineering systems and statistical formulae Topics such as control charts engineering economy health operational efficiency healthcare systems human systems integration Lean systems logistics transportation manufacturing systems material handling systems process view of work and Six Sigma techniques The premise of the handbook remains to expand the breadth and depth of coverage beyond the traditional handbooks on industrial engineering The book begins with a general introduction with specific reference to the origin of industrial engineering and the ties to the Industrial Revolution It covers the fundamentals of industrial engineering and the fundamentals of systems engineering Building on this foundation it presents chapters on manufacturing production systems and ergonomics then goes on to discuss economic and financial analysis management information engineering and decision making Two new sections examine safety reliability quality operations research queuing logistics and scheduling The book provides an updated collation of the body of knowledge of industrial and systems engineering The handbook has been substantively expanded from the 36 seminal chapters in the first edition to 56 landmark chapters in the second edition In addition to the 20 new chapters 11 of the chapters in the first edition have been updated with new materials Filling the gap that exists between the traditional and modern practice of industrial and systems engineering the handbook provides a one stop resource for teaching research and practice

Learning Curves Mohamad Y. Jaber, 2016-04-19 Written by international contributors Learning Curves Theory Models and Applications first draws a learning map that shows where learning is involved within organizations then examines how it

can be sustained perfected and accelerated The book reviews empirical findings in the literature in terms of different sources for learning and partia Handbook of Industrial and Systems Engineering Adedeji B. Badiru,2005-12-15 Responding to the demand by researchers and practitioners for a comprehensive reference Handbook of Industrial and Systems Engineering offers full and easy access to a wide range of industrial and systems engineering tools and techniques in a concise format Providing state of the art coverage from more than 40 contributing authors many of whom a Policies for Multi-skilled Worker Selection, Assignment, and Scheduling Karndee Leopairote,2003 **International Journal of Production Economics** ,2003 *Practitioner's Guide to Quality and Process Improvement* A.B. Badiru,B.J. Ayeni,1993-09-30 The quality revolution Fundamentals of quality improvement Fundamentals of process improvement Project management approach to quality and process improvement Process management and control Statistical tools for quality improvement Additional statistical techniques *Framework for Large-scale Dynamic Programming with Application* Bex George Thomas,2007

Supply Chain Management A. G. de Kok,Stephen C. Graves,2003-12-05 This handbook contains chapters covering a broad range of supply chain management issues written by leading experts in the field It is aimed at researchers students engineers economists and managers involved in supply chain management Dissertation Abstracts International ,2000

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Organizational Behavior Walter Jack Duncan,1981 Management Science ,2006 Issues for Feb 1965 Aug 1967 include Bulletin of the Institute of Management Sciences **Industrial and Labor Relations Review** ,2012

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