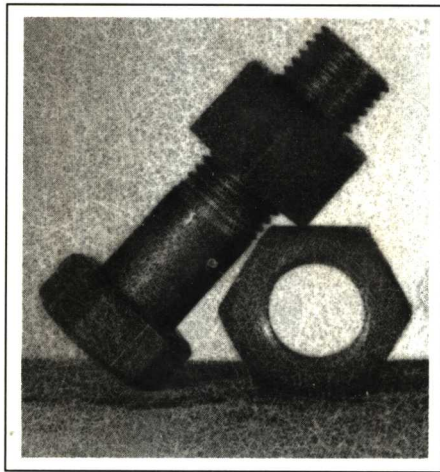


SMART.◆

SIMPLE

DESIGN



USING VARIETY
EFFECTIVENESS TO
REDUCE TOTAL COST AND
MAXIMIZE CUSTOMER
SELECTION

G. D. GALSWORTH

SMART, SIMPLE DESIGN

Using Variety Effectiveness
to Reduce Total Cost and
Maximize Customer Selection

G. D. Galsworth

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*To my dear Mother, Geraldine M. Galsworth,
source of inspiration, strength, and joy.
Thirty-nine years young has never looked more beautiful on anyone.*

*And to the Unity that is God,
Who makes all parts—however diverse and however various—One.*

Acknowledgments

Smart, Simple Design is a book of two journeys—the first to discover the VEP methodology, the second to discover the book itself. In truth, the totality of these two streams of effort had many creators, those people who helped me find the principles, concepts, and techniques of the variety effectiveness approach, and those who assisted me with words, images, and form so the knowledge could be structured into a book and conveyed to you, the reader. People gave freely: information, clarification, verification, validation, extension, implication, illustration. And support. I know that I could not have done it without them. I want them to know that too.

First among these remarkable people is Dave Reis, president of United Electric Controls Company (UE) in Watertown, Massachusetts. His quiet leadership allowed VEP to take seed and take root at UE. I am also grateful for Dave's willingness to let me model some aspects of the book's prototype "struggling" company (Parts Unlimited Inc.) after UE, an organization of exceptional assets.

Another person at UE whose contribution was invaluable is Bruce Hamilton, VP of Operations. Bruce is a visionary. He saw the need for variety control and reduction as a distinct issue at UE and put out the call for my assistance. I had been working with UE for several years already and was continually amazed at the way the company kept shifting to improve. These shifts were invariably linked to specific methodologies the enterprise had learned, adapted, and applied: kanban, improvement teams, action centers, JIT, one-piece flow, work cells, suggestion systems, customer/supplier partnerships, and policy deployment through the X-Type Matrix. The company had established itself as a leader in best practices. It came as no surprise when UE won the 1990 National Shigeo Shingo Prize for Manufacturing Excellence.

Still it was not enough. Parts count was ballooning, and there was a

complexity in the organization that defied efforts to define it, let alone unravel it. The old answers were not working, and the company's march toward manufacturing excellence seemed stalled. Bruce knew a new solution to the inventory problem had to be found, one that would allow the company: (1) to identify the problem more accurately, (2) to get to its true causes or triggers, (3) to eliminate or drastically reduce parts count, and (4) to make sure it didn't come back.

In 1991, Bruce's search led him to *Variety Reduction Program: A Production Strategy for Product Diversification* (Cambridge, Mass.: Productivity Press, 1988), a book written by Toshio Suzue and Akira Kohdate which provided a fresh perspective on parts inventory. Bruce organized a weekly lunchtime study group, charged with the mission: Understand the book; then implement it at UE. Volunteers began meeting. After about two months, the group had grasped the importance of the concept but was flagging in terms of application. As is the case with many books from Japan, the authors provided plenty of why-to but far less how-to. Bruce called me in. The journey of discovery was about to begin.*

Bruce, the study group, and I were quickly joined by many UE employees as a series of teams were formed around the central issues of runaway variety. The VEP methodology and *Smart, Simple Design* were born of that effort. My heartfelt appreciation to Bruce Hamilton for his discernment, and for his contribution to the policy chapter, conceptualization of the Early Victories Team, and coining of the term "variety effectiveness," infinitely more appealing language to sales and marketing than the earlier "variety reduction."

I also thank Bruce for asking Bonnie Rafuse (former UE Training Manager) to work on the VEP project with me. Committing to myriad tasks as only she can, Bonnie's involvement in early development days was invaluable. Her resourcefulness, thoroughness, and energy kept VEP's fledgling teams on track and supported. Bonnie also headed up the

* At the time, I was the director of business development and senior consultant at Productivity Inc. (sister company to Productivity Press) and saw in Bruce's request the possibility of creating a new practice area for Productivity clients. My deep appreciation goes to Norman Bodek, president of Productivity Inc. and Productivity Press, for his discerning support of the initial project and his continuing interest in VEP after I left the company some months later.

Education and Methods Team, contributed to content development, and coordinated the entire project. I thank you, Bonnie. You were a linchpin.

Another UE pro stepped in when Bonnie left the company for new opportunities—Patricia M. Wardwell. Pat is a star! She is sharp as a tack, politic, and widely experienced in manufacturing. Her pursuit of the truth (yes, there is truth in manufacturing) is relentless. For well over a year, we joined forces to continue surfacing the VEP methodology. Then the book took over. Through a blizzard of phone calls and faxes, at her UE desk and at her kitchen table, Pat scoured the pages and kept me on track. Especially during the final weeks of writing, when book deadlines and details were running my life, I “blessed” her name many times. Pat, thank you. And now, in Pat’s “spare time,” she trains and consults on VEP.

Maureen Hamilton also joined in the support of the project at the midpoint, and was often the only person who could find missing archives and elusive people (like her husband, Bruce). Her patience, competence, and good humor are legendary. If it could be done, found, or gotten, Maureen did. Thanks, Maureen, for the support and all those great laughs.

I am grateful to so many people at UE. Thanks to members of what became known as the “3-View Analysis” team: Arthur Barter, Levon Khatchadourian, Joe LePage, Aram Minassian, John Mondello, Berg Narjarian, Fernando Rego, Ed Velosa, and Gerry Yuskas, its fearless leader. And thanks to members of all the other VEP teams: Guy Alger, Gladys Appleby, Cindy Barter, Frank Barter, Tom Brennan, John Burke, Carlos Chaves, Bill Colby, Mike Contardo, Chris Cronin, Tony Cruz, Judy DeMartin, Mark DeNovellis, Dan Fleming, Jodie Glennon, Diana Hajian, Don Holm, Chris Jaffier, Don Jones, Joe Lyons, John Machado, George McGary, Maryrose Mix, Ryta Mullen, Al Nashawaty, Charlie O’Hearn, Manny Pereira, Paul Plant, Janet Raposo, Lee Sacco, Bob Sanders, Jim Silva, Joe Silva, Joan Sampson, Dave Smith, Terry Sousa, Hieu Tran, Bud Tucker, Dave Vaughan, Allan Waugh, Dave Williams, Pat Woods, and those whom I may have overlooked by name. Thanks also to Cheryl O’Connell, for her inventiveness and laser focus in leading control point reduction. And, finally, special thanks to that dynamic duo, Bob Rando, database maestro *par excellence*, and Barbara

Murphy, for their unwavering MIS assistance—tracking part counts, running sorts and quizzes, setting up attribute fields, and on and on. Thank you UE!

I can honestly say that this book would never have been written without Patricia E. Moody. Tricia is an astute manufacturing consultant, specializing in—just about everything. She is also editor of *Target* magazine. When I told her about VEP and my work at UE, she said point blank: “This is important—you need to write this book *so I can read it!*” Immediately, Tricia put me in touch with Oliver Wight Publishing and Jim Childs. The second journey began. But Tricia did more. She made her extraordinary creative gifts and writing expertise available to the manuscript, as well as her cogent insights into the world of business and profit. Tricia, I am deeply indebted to you for all you have done. Thank you.

John R. Clegg contributed immeasurably to the book through its art work and his computer sorcery. Imaginative, persistent, and immensely skilled, John is head of graphics for the Technology and Product Development Directorate at Arthur D. Little but still found time (on the weekends) to assist on the book. My thanks to you, John, for your beautiful work and to your wife, Jaimie and little Ian, for letting me steal so much of their time with you in the last weeks of the manuscript.

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Every writer knows that dealing with the technical portion of a book is only half the story. The other half is keeping one's spirit whole and body together. For their miraculous help in this, I am deeply grateful to: Dawn Bothie, Swami Chetanananda, Vivian Everett, Judy Harmony, Mataare, William Mueller, Margo Schmidt, David Sollars, and David Whyte.

And finally my eternal gratitude to Samual N. Bear, Anderson Merlin, and Philip Hylos for their creative encouragement, heartfelt support, and unwavering guidance. Truly, this book would never have been started or completed without them.

GWENDOLYN D. GALSWORTH

September 1994

FOREWORD

by Bruce E. Hamilton

In 1987, when United Electric (UE) first began using the inventions of the Toyota Production System, we focused narrowly on our factory, seeking to eliminate waste from the production process. We were, as Shigeo Shingo put it, “constructively dissatisfied” with our production capability and determined to find a better way to manufacture. For the next three years, our success in reducing inventory and improving service was so great that it consumed our attention. As we examined and understood the huge waste from overproduction, for example, that had been created as we filled our stockrooms with large lots of partially completed product, we reduced lots from “nice round numbers” to the minimum order quantity. Then, as quick changeover techniques were employed, lot sizes were further reduced. Assemblies, previously produced in lots of 1,000 and then sorted for later use, were now triggered for production by a system that dictated that we build only what was needed, when it was needed, and in the smallest quantity determined by setup times.

All improvement could be measured by time saved: A reduction of the total elapsed time to fill a customer’s order, a reduction in product development time to qualify a new supplier. Every invention we employed was directed to that end: Make the process go faster by eliminating waste. By 1990, our stockrooms had been eliminated and inventory had been reduced by 65 percent—many millions of dollars. Lead time dropped from months to days and perceived service was at an all-time high. Cellular production reduced flow distance from miles to feet and created a wholly new set of team and problem-solving skills required for production to work in a new way. For those of us in Production, this was an

exciting time in our careers. We were changing the way things were done, and we were changing ourselves in the process.

Just when it seemed things couldn't get any better, they *didn't* get any better. Concepts such as kanban, cellular manufacturing, single-minute exchange of dies, and *poka-yoke* had produced huge early results, but now were considered the norm, the basis for daily production. And on that basis, improvement leveled off. Inventory dropped so far, and then stopped dropping; likewise with lead times. While the cycle of improvement is never-ending, the tools used in that improvement cycle tend over time to become maintenance tools rather than improvement tools. What further tools could we identify to break through the improvement plateau?

Once we had stripped away some of the grossest forms of waste in our business—large inventories, useless material handling and storage equipment, even excess buildings—we began to see a major new opportunity for improvement. There was a huge cost, both in time and money, for every part in our system that was *separate* from the functional cost of the part. In Production, we had learned how to identify waste in seven forms as taught by Toyota: Storage, transportation, overproduction, unnecessary processing, motion, defects, and waiting. In 1991, UE began working with Dr. Galsworth to establish a systematic method for identifying and eliminating an “eighth” waste—*unwarranted variety*.

Through the use of SMED (single-minute-exchange-of-dies), we reduced many lot sizes to one—but even for that one piece, we had to activate our entire production system. Now there appeared to be a means for reducing the variety costs associated with many parts by simply eliminating the part. This, in fact, we had addressed in a piecemeal fashion from the early days of our improvement process. However, in the absence of a clear method for measuring and identifying the trade-offs associated with variety—and more important, for *understanding* the root causes of variety—we seemed to be adding new variety at least at as great a rate as we were removing old variety. With thousands of parts and processes in our production system, the complexity of the problem dictated a new method for solution. This has evolved today into what Dr. Galsworth calls *variety effectiveness*.

Dr. Galsworth's book is the first thorough treatment of a method that can systematically identify the waste of needless variety. For older busi-

nesses especially, this book provides a blueprint for cutting back the mass of parts and processes resulting from years of product proliferation. But every business, established or start-up, can benefit from the methodology that extends the power of the Toyota Production System beyond production and into the design and development process. Most variety in part design, product structure, and process selection does not result from a customer's need, but from a series of internal policies and behaviors that needlessly complicate the production process. These include cost-accounting systems that actually *reward* part and process proliferation, engineering mores that eschew the use of previously developed designs, variety resulting from technology change, and inadequate design tools that actually make it easier for designers to develop a part from scratch than to search for an already-existing part. The customer is not in the equation.

The key benefit to designers in the method developed by Dr. Galsworth is that it supports broad selection for the customer while reducing variety in the product design in a manner transparent to the customer. By understanding which variety is negative, engineers and designers can contribute to profitability and service in a way that was not previously possible. VEP's simple but powerful techniques enable engineers to change the way they work, to work faster, and to develop products of exceptional selection that meet individual customer needs without adding layers of complication and cost to the production process. Dr. Galsworth's detailed process for improvement arms designers with a systematic method for identifying, classifying, and reducing unneeded variety.

For product marketers, the Variety Effectiveness Process® represents an alternative to the all-too-common process of product-line trimming and selection retrenchment. By minimizing the cost and time of new product development, VEP brings more new products to customers sooner. And it revitalizes old products through its dramatic cost-reduction potential.

For Production, the benefits are reduced part and process complexity, reduced equipment expense, reduced training expense, reduced material handling, improved turns, less stockouts, and fewer defects.

And for corporate management, there is the powerful message:

Corporate structure mirrors product structure. Simplify the first and the latter will follow. For United Electric, VEP has offered the opportunity for a second wave of improvement. I view variety effectiveness as an approaching revolution in the product development process. Its effects will touch all aspects of an organization's competitiveness and financial well-being. Dr. Galsworth's book is an excellent place to begin this process.

BRUCE E. HAMILTON

Vice President, Operations

United Electric Controls Company

Watertown, Massachusetts

Vice-Chairman

Shigeo Shingo Prize for Manufacturing Excellence

ABOUT THE AUTHOR

Gwendolyn D. Galsworth is founder and president of Quality Methods International Inc. (QMI), a consulting and training firm based in Massachusetts that specializes in systematic improvement approaches, including the visual workplace, variety effectiveness, strategic matrix policy deployment (*hoshin kanri*), and team problem solving.

Previous to forming QMI, Dr. Galsworth was Director of Business Development at Productivity Inc. and principal developer of such core Japanese-based methods as visual control systems and the 5-Ss, zero defects through *poka-yoke/failsafe* systems, and *CEDAC*[®] (cause and effect diagram with addition of cards). She was also instrumental in adapting *TPM* (*Total Productivity Maintenance*), *SMED* (single minute exchange of dies), and *TEIAN* (Japanese suggestion approach) for western audiences.

With over a dozen years in the field, Dr. Galsworth has assisted companies, large and small, to accelerate their rate of improvement and become superior competitors. These clients include Alcoa Aluminum/Australia, Continental Can, Crompton Greaves/India, Culinar Foods/Canada, Furon Company, General Motors/Canada, Hamilton Standard, Honeywell, ITT/Aerospace, Motorola, Marada Industries, Packard Electric, Pratt & Whitney, Prince Corporation, Simpson Timber, TVS Sundaram Clayton/India, and United Electric Controls Company.

A two-term Malcolm Baldrige examiner, Dr. Galsworth is an expert in Total Quality Management/TQM and frequent speaker on quality and productivity improvement. She periodically leads study missions to some of Japan's finest production facilities.

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PART ONE

The Dilemma: The Need to De-Complicate
