THE SCIENTIFIC THINKING MECHANISM

SHIGEO SHINGO

KAIZEN AND THE ART OF CREATIVE THINKING

FOREWORD BY JEFFREY K. LIKER
AUTHOR OF THE TOYOTA WAY

Published by
Norman Bodek
Co-founder of the
SHINGO™ PRIZE
for EXCELLENCE in
MANUFACTURING

Originally published as *Idea wo Nigasuna*, copyright 1959 by Hakuto-Shobo Publishing Company, Tokyo, Japan.

Enna Products Corporation
1602 Carolina St.
Unit B3
Bellingham, WA 98229
Telephone: (360) 306-5369
Fax: (905) 481-0756
E-mail: info@enna.com

PCS Inc.
809 S.E. 73rd Ave.
Vancouver, WA 98664
Telephone: (360) 737-1883
Fax: (360) 737-1940
E-mail: info@pcspress.com

Printed in the United States of America

Library of Congress Control Number: 2007935987

Library of Congress Cataloging-in-Publication Data
Shingo, Shigeo, 1909-1990
Kaizen and the Art of Creative Thinking
Includes index.
ISBN 978-1-897363-59-1

1. Lean Manufacturing 2. Idea generation. 3. Improvement initiatives

taught how companies could improve quality. The Japanese listened; we did not.

Based on the success of the Deming Prize in Japan, Vern and I thought that an American manufacturing prize might spur on American industry to "wake-up" to the international challenges. We both thought, based on the discoveries of Shingo, that it would be appropriate to name the American prize after him.

Vern and I then invited a group of senior American executives to form the initial board of directors of the prize. Shingo and I contributed $50,000 for the start of the prize and Vern got Utah State University's Partners in Business to initially sponsor the prize.

The board set up the criteria for the prize and sent out request notices to American industry. At the time, as president of Productivity Inc. and Productivity Press, I had an enormous mailing list to solicit applications. I remember, close to a year later, we had received around a dozen applications for the prize. At that board meeting we reviewed and discussed which companies were worthy of winning the initial prize. One board member was adamant that no company was worthy of winning the prize. He said, "No company has passed the criteria set for productivity improvement." I chimed in, "look we have a prize; we must have a winner." It was a fierce discussion. I told the group to take a break and since Shingo was there to speak at the conference, I went to get his advice. He said, "Norman, you treat the prize just like a beauty contest and give it to the best company." With Shingo's powerful statement, it was easy for me to convince all of the other delegates, but one, that we would pick out the best company to win the prize.

We did and the prize has only been growing stronger every year these past 20 years.

And subsequently, Vern delivered. Utah State University did award Shingo an honorary doctorate degree. I remember the moment very clearly. Even though it was very difficult for

Shingo to walk at the time, he did and participated in all of the processions. As the honorary doctorate degree was awarded he gave a brilliant speech to the auditorium filled with students, teachers, friends and families. It was Dr. Shingo's proudest moment.

When he died less than a year later, his wife placed his cap and gown around him and displayed him that way for the funeral ceremonies.

Dr. Shingo was probably the greatest manufacturing consultant of the last 100 years. I am still indebted to Utah State University for recognizing the contributions of Dr. Shingo to American industry.

Co–publisher,

Norman Bodek

Advanced Praise for Kaizen and the Art of Creative Thinking

"In this book we learn how Dr. Shingo thinks about problems. You will not be overwhelmed by flowery prose and deep theoretical discussions in a Shingo book; what you will get is a straightforward methodology and examples to illustrate each concept."

Jeffrey Liker
Ph.D., Industrial and Operations Engineering
The University of Michigan

"This book contains a myriad of case studies taken from office examples as well as shop floors. It is a gold mine of improvement ideas that cumulatively must have saved millions, and will still do so today!"

Don Dewar
President & Founder
Quality Digest Magazine

"Practicing kaizen (the habit of making small improvements) eludes many people. Dr. Shingo's Scientific Thinking Mechanism replaces the hope of the flash of creativity with a reliable and learnable habit-building approach. Thanks for making this Rosetta Stone for kaizen available to the world."

Hal Macomber
Principal
Lean Project Consulting, Inc.

Advanced Praise for
Kaizen and the Art of Creative Thinking

"*Kaizen and the Art of Creative Thinking* is a revealing book and is the genesis manuscript to the Lean Manufacturing mindset. It captures the fundamental thought process to structure problem solving activities and is the foundation to all essential aspects of the Kaizen philosophy. The management principles and models advocated by Dr. Shingo are precursors to the Toyota Production System. Dr. Shingo's students like, Taiichi Ohno, are engaged as active players substantiating Dr. Shingo's role at Toyota. Reading this book provides the underlying ethos to Toyota's success. Truly a wealth of knowledge, wisdom and frameworks to embolden you to change existing practices!"

Michel Mestre, Ph.D.
Professor, School of Business
Northwest University

"*Kaizen and the Art of Creative Thinking* focuses on the thinking portion of problem solving, making improvements and meeting opposition to the guardians of the status quo. There are a great number of improvement examples in this book to clearly explain Shingo's points which I found extremely helpful and entertaining. Some of the information has been written about before but there are plenty of new insights to make this book a must read for those of us on our lean journey."

Mike Wroblewski
President
Victory Alliance Technologies, Inc.

Advanced Praise for
Kaizen and the Art of Creative Thinking

"This book is great. Norman Bodek has discovered another goldmine of information for us to enjoy. Shingo's earlier books were real masterpieces that described in detail the techniques and the principles behind each revolutionary practice of the Toyota Production System. They were a real windfall to practitioners of Lean as they distilled decades of knowledge and presented it with a large number of actual examples making it easy to assimilate and apply. This book goes a step further as it deals with the thinking process that underlies Shingo's genius. I think this is just what the Lean movement needs to help it spread beyond manufacturing, and into other sectors such as services and healthcare."

T.V. Suresh
President
Tao Consultants

"For those of us who have revered the work of Dr. Shingo, this is an exciting work. More so than any other of his books, *Kaizen and the Art of Creative Thinking* gives us insight into the 'how' of Dr. Shingo's developments and accomplishments. His perspective is based in practical, real-world opportunities, not encumbered by complex theory and management rhetoric."

Bill Kluck
President
Northwest Lean Network

TABLE OF CONTENTS

the machine. Get the design of the machine right and figure out scientifically the one best way for the person to do the job and direct the person to do it—punishing deviations from the design and rewarding compliance. These were the principles of Frederick Taylor's "Scientific Management" and very much reflect Western engineering thinking.

Dr. Shingo naturally gravitated toward the TPS philosophy rooted in the East. The factory is viewed as a system of humans using equipment to satisfy customers. The world is viewed as dynamic and complex and no engineer, no matter how smart, can anticipate in detail what will happen. The engineer's design is a ball park that serves as a starting point. People then make fine adjustments and improvements every day to learn the weaknesses of the system in order to strengthen it. The people doing the work have the best vantage to directly experience the complexities of the process and to identify its weaknesses. This produces and environment where it is safe to admit problems and get help to solve those problems. Through daily improvements (Kaizen), the system adjusts and adapts to changes in the environment and grows ever stronger. While in the mass production system the process is set to roll along as designed by the engineer and entropy inevitably sets in; with TPS, however, it is the people within the system that continually improve the system, making it better and better.

Dr. Shingo was a master of Kaizen. He had the scientific training and innovative genius to deeply understand processes and the humility to realize that he needed the operators to take ownership. I heard a great story about Dr. Shingo from a former executive of Kentucky Fried Chicken. They engaged Dr. Shingo as a consultant and at that point he was quite old, rolling into one of their restaurants in a wheel chair. He immediately wanted to see the entire operation and quickly determined it was a batch process based on push. It took a long time to cook the chicken so they prepared batches in advance and then heated them when they were ordered. That meant the chicken wasn't as fresh as it could have been and created undue waste. Dr. Shingo wanted to

know why they did not cook to order; again they explained this was physically impossible given the time to cook the chicken. Dr. Shingo then sketched out a quick cook process that would allow them to cook to order. The executive's paradigm was instantly changed in that moment. He is now one of the top executives of one of the largest banks in the world and he immediately set to work applying TPS to banking. He had no hesitation about applying TPS to this very different type of process after learning the power of Kaizen and innovative thinking from Dr. Shingo.

In this book we learn how Dr. Shingo thinks about problems. You will not be overwhelmed by flowery prose and deep theoretical discussions in a Shingo book; what you will get is a straightforward methodology and examples to illustrate each concept. Those familiar with Toyota's practical problem solving will note the similarity perhaps because of the broad influence Shigeo Shingo had on TPS. You will learn about clearly defining the problem based on facts, questioning assumptions, the power of deep observation, using association to generate ideas, and overcoming resistance to new ideas. Those familiar with Toyota's thinking know that so much of the emphasis is on the up-front processes of properly defining the problem and thinking in terms of many alternatives. This is mostly the focus of this book and it is brought to life through real life examples of true innovation.

This book will help you understand the deep thinking that underlies the real practice of TPS. Many people seem more comfortable copying other people's "lean solutions." This is completely contrary to the spirit of TPS, which is actually about grasping the specific situation, thinking creatively, and constantly challenging your assumptions. We are fortunate to have this new opportunity to gaze deeply into the thinking of one of the true geniuses behind TPS—Dr. Shigeo Shingo.

Jeffrey K. Liker, Ph.D.
Professor, Industrial and Operations Engineering
The University of Michigan

Collin McLoughlin

Without Dr. Shingo, the Toyota Production System would not be what it is today. In fact, a few years back Mr. Toyoda, former chairman of Toyota, was dedicating the opening of Toyota's first Chinese plant, and looked at Dr. Shingo's son, the president of Toyota China and said, "If it wasn't for Shingo's father Toyota would not be where they are today."

There has been much talk about the origins of the Toyota Production System and Dr. Shingo deserves significant credit for its creation. When you look at the life of Dr. Shingo and learn that he consulted with over 300 companies world-wide, such a debate becomes trivial. Yes, Toyota would not be the same without the benefit of Dr. Shingo's incredible mind, but if we look at the larger context of his life we see that Toyota is not the driving force behind his legacy. The fact that so many global companies entrusted their operations to his capable hands is Shigeo Shingo's true legacy.

This book has never been published in English; it is a newly discovered classic that will take its rightful place on every bookshelf along with Dr. Shingo's other great books. The book is designed to shake the foundation of the status quo. It will unveil the secret operational model that has never been seen in its entirety. Dr. Shingo's *Scientific Thinking Mechanism* is a proven model that has remained hidden for the last 50 years. Designed to systematically provide you with the method and structure to generate the ideas needed to get ahead and stay ahead. For brainstorming techniques, he teaches us how to stimulate the "silent area" of the brain where ideas are born. Most importantly, he instructs us to take objections to new ideas as advice, a powerful tool to be used when persuading people to accept improvements.

The analytical portions of this book rise above its technical nature due to Dr. Shingo's conversational writing style. His ability to illustrate points using humor and shop floor anecdotes will sharpen your mind as well as clarify your management

approach. For the first time we have the principles, framework, and insight into the mind of the *original* Lean Manufacturing genius. For decades, Shigeo Shingo was the man to call to take a good company and turn it into a *great* company. His legacy and influence still guide us today; we only need to listen.

Norman once went to a Chinese restaurant where his fortune cookie said, "You have the ability to recognize the ability in others." How true! Norman's influence in the West is a direct reflection of the influence Dr. Shingo had on Norman. Their professional and personal relationship continues to have a profound and everlasting impact on industries around the globe.

Finally, we would like to thank the author, Dr. Shigeo Shingo, for his passion to improve the quality of life for everyone on the shop floor. By teaching us how to tear down the walls of the status quo, he demonstrates to us how to sharpen our minds to create and direct our own destiny.

Collin McLoughlin and Norman Bodek
Co–publishers

Acknowledgments

We would like to acknowledge the hard work of the following people: Satomi Umehara, for the precision of her translation from the original Japanese text; Tracy S. Epley, for his careful editing of the manuscript; and Khemanand Shiwram for design layout and his faithful reproduction of the original illustrations. We would also like to acknowledge our indebtedness to Mrs. Umeko Shingo, wife of Dr. Shingo, for discovering this book for us.

Collin McLoughlin and Norman Bodek
Co-publishers

I Principles of Analytical Thinking

Science is defined as the systematic arrangement of knowledge. Systematic thinking and analysis is the key to successful problem solving and improvement.

The Edge of Night

A: What marks the boundary between day and night?

B: The setting of the sun, of course.

A: If that's the case, then why is it still light outside at sunset?

B: Well, how dark does it need to be? How about now, is this day or night?

A: This debate could go on all night. Why don't we simplify things and just call this ambiguous time period, "twilight"? Besides, it has a nice ring to it.

And so the conversation ends. Now, where do you draw the line between day and night?

Principle of Division

Let's assume that we are dividing the people in your department into different groups. First, we can divide them into male and female. Other possible classifications are:

1. Adult or youth
2. Business assistant or engineer
3. Those who are healthy or those who tend to be sick

Principle of Division Grouping Example Table 1

Male or Female	Gender
Business Assistant or Engineer	Skills
Adult or child	Age
Healthy or Sick	Health Performance

The method used to create grouping criteria is called the "Principle of Division." When choosing criteria by which a group will be divided it is important to consider what kind and how many, divisions will be made. Furthermore, in order to prevent subsequent divisions from becoming vague or impossible, a "parent group" could be divided into a "grandparents and parents" group that is clearly distinct from one another, as in the manner of "A or not A."

Contrast and Continuation

I said to divide clearly, but there is a problem here. In the parent group there are "contrasting groups" which can be separated clearly, as in A or not A:

- Male or female
- Business assistant or engineer

And then there are "continuous groups" in which the distinction between two is not as easy to discern:

1. Adult and youth

2. Those who are healthy and those who tend to be sick

The Principles of Division governing the separation of continuous groups, such as age or health performance, are often hard to discern. As such, making a clear division in these groups can become difficult. In other words, dividing contrasting groups is easy, but dividing continuous groups often times is not.

At what age, do you think, does one transition from youth to adulthood? When the criteria for divisions are continuous like this we need to make a clear definition. For example, we could define those over 20 as adults. In terms of health performance, we would also need to make definitions, such as those based on healthy pulse, blood pressure, etc. However, it is somewhat odd to define someone who will turn 20 the following day as youth, and one who just turned 20 the previous day as adult.

As these examples illustrate, in the case of continuous groups it is essential for dividing criteria to be as clear and distinct as possible. However, even after assigning a definition it is possible for something to remain innately unclear. Therefore, if a parent group is a continuous group (such as distinguishing between 35 and 36 year old people), we should be fully aware of the difficulties that can arise when dividing it.

No Confusion, Yes?

Three brothers went to see their uncle in the country. He had two dogs.

Ichiro, being the oldest and tallest brother was the first to see them. "Look, the big dog and the little dog!" he said.

Jiro, who showed up later, said, "Oh, it's the red and white dogs."

The youngest brother, Saburo, heard his brothers' voices and came out of the house. "Oh boy! The white nosed dog and the black nosed dog," he said excitedly.

The confused dogs must have thought, "They are giving us

so many different names. What will we do if they call them all at once?"

Cross Division

A similar case could happen in a more familiar situation as well. Mr. Koga, who is in charge of material procurement, made four files related to the following:

1. Yawata Steel Works
2. Fuji Steel
3. Steel plate
4. Mold steel

Now, if you have an invoice of mold steel from Yawata, would you file it in number one or number four?

Trying to divide a parent group based on two different criteria is called "cross-division" and can often lead to confusion.

In the case of "the boundary between day and night," one source of confusion stems from the fact that two different division criteria, the time of sunset and the brightness of the sky, are imposed simultaneously. Another source of confusion originates from the inherent problems of brightness being a continuous group.* Consequently, the difficulties encountered when addressing this issue could be greatly reduced if the criterion for division is limited to brightness, and a clear boundary between day and night is defined. By categorizing our thoughts in this manner the question posed in the opening dialog could have been answered easily.

It is not uncommon for similar issues to pop up in daily conversation. For example, someone might say, "He is a stubborn capitalist, and an enemy of democracy!" This is a perfect example of cross-division.

---

*Astronomers have done this by classifying the intensity of light coming from distant stars.

What we need to compare to capitalism are other economic paradigms such as socialism, communism, and dictatorships that sit vis–à–vis democracy. There are of course other contrasting political ideas, such as internationalism versus nationalism.

When examining the differences between groups such as these it is crucial to acknowledge and properly evaluate the "gray area" that is likely to color the gap separating opposing views. Doing so can raise one's awareness for cross–divisional errors and help to minimize passing unfair judgment onto others during emotional discussions.

Perception is Reality

Reality is the man of twenty faces.* Let's assume that at Factory X the number of defects have steadily increased. In this case, things that should be taken into consideration are the following:

- If materials were satisfactory
- If processing methods were appropriate
- If inspections were done appropriately
- If handling of materials was proper
- If handling during transportation was appropriate
- If defects happened because materials were left unused for too long

Other things to take into account are:

- Components, hardness, strength, length, diameter, or surface roughness of the materials
- Processing machines, tools, workers' skills, and characteristics

*Fictitious criminal mastermind, Kaijin Niju Menso (The Mystery Man of Twenty Faces), nemesis of detective Akechi Kogoro whose exploits first appeared in an eponymous 1936 magazine serial in Japan.

- Lighting, noise, humidity, air quality, dust, temperature of the work area
- Methods of cutting, heat treatment, plating, and rust-removing
- Measuring devices for inspections, measuring environment, issues with inspectors
- The way products are placed, storage containers used, and the environment in which they are stored
- Packaging for transportation and types of transporting machines
- Whether the defect is in fact critical, considering the intended end–use of the product

This list demonstrates the extraordinary number of causes that could be contributing to the recent increase in defects. Things in reality have far more facets than we may realize. When faced with a problem like the one above we often attempt to solve them by simply focusing on a few causes we happen to put our finger on.

Things in reality are never that simple. They include:

- Many levels of divisions
- Continuous groups, and thus qualities inherently difficult to divide
- Numerous opportunities for cross–division, which inevitably leads to confusion

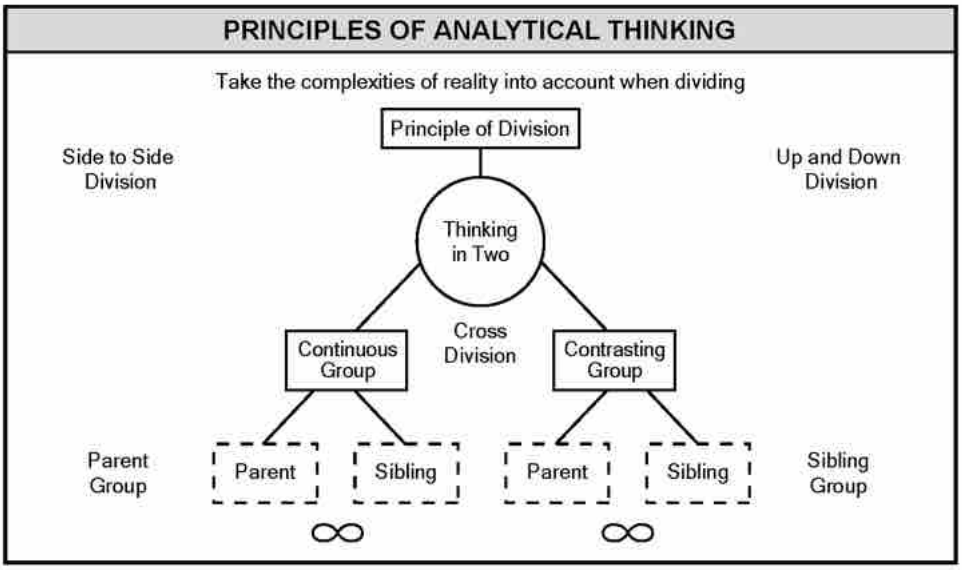
It is important to acknowledge the complexity of reality; it is comprised of a multitude of internal variables.

Bigger than a Breadbox?

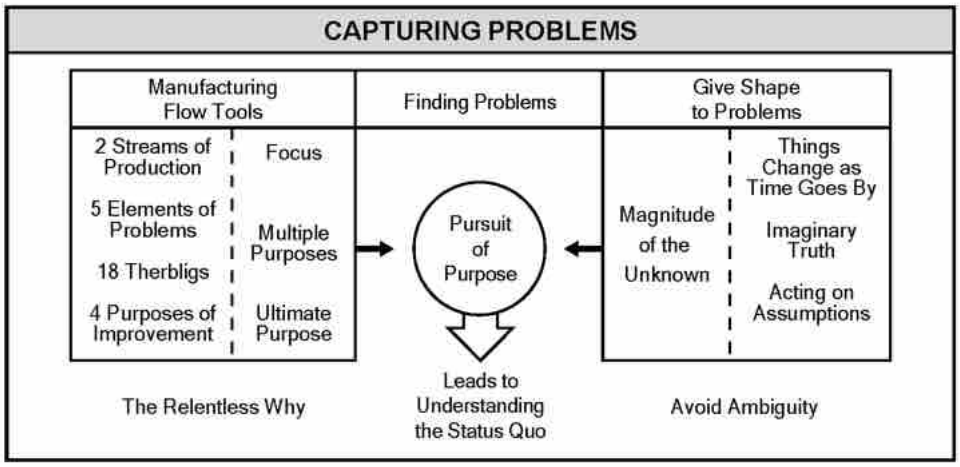
When searching for the correct answer in question games such as "Who Am I?" or "Twenty Questions," having a good memory is helpful, but having the ability to apply analytical thinking skills

Scientific Thinking Mechanism Components By Chapter

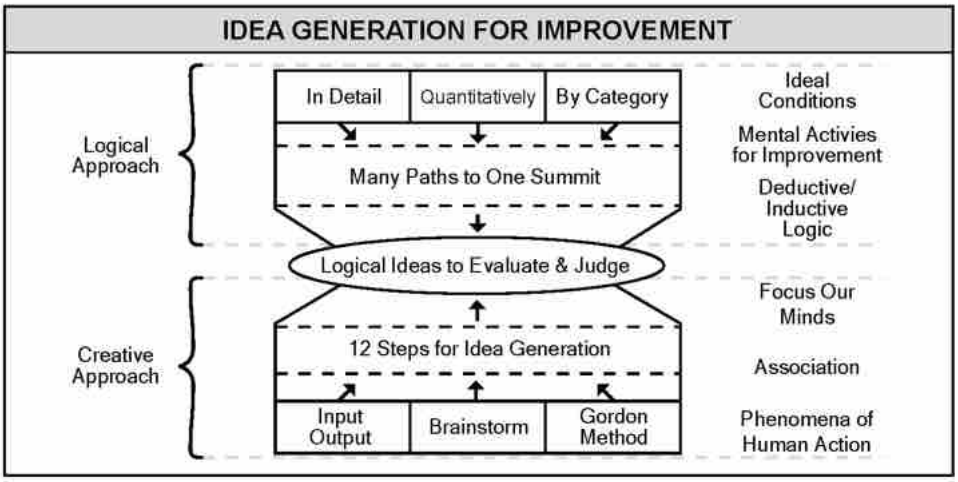
Chapter One



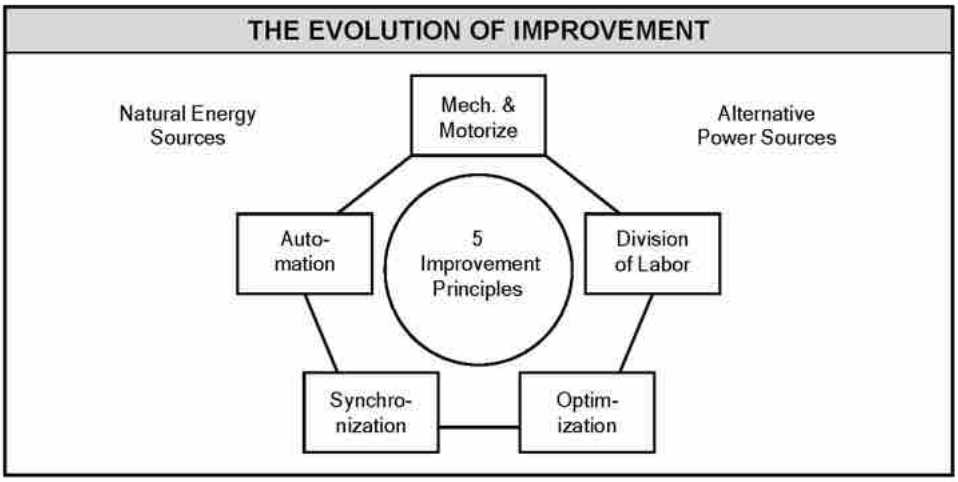
Chapter Two



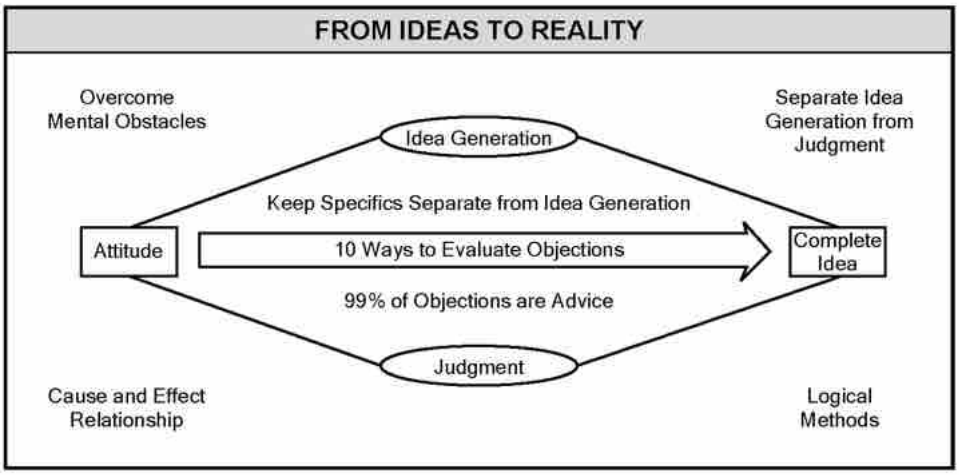
Chapter Three



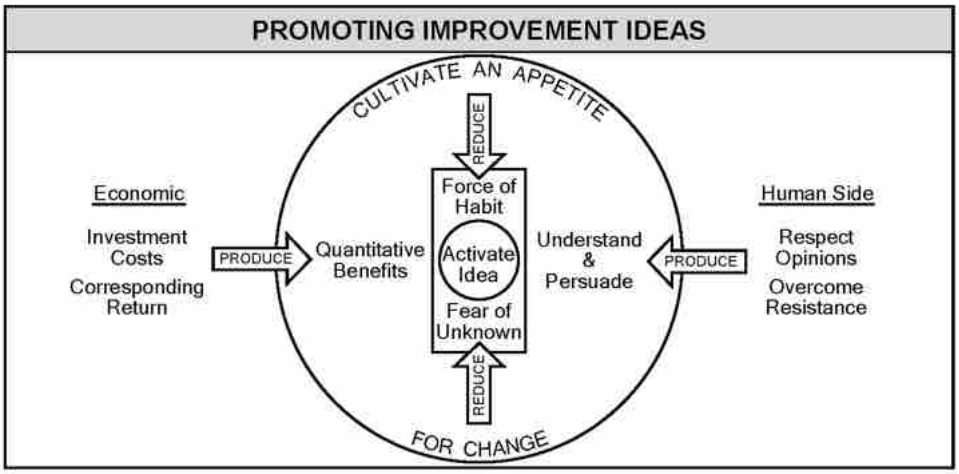
Chapter Four



Chapter Five



Chapter Six



1950	After studying and reflecting on the problem of layout, he perfects and implements a method based on a coefficient of ease of transport at Furkawa Electric's Copper Refinery in Nikko. The first stages of SMED are birthed during analysis work at a press at Toyo Kogyo. This involves splitting set-up operations into internal and external set-ups.
1951	He encounters and then applies statistical quality control in his role as Head of the Education Department.
1954	A representative from Toyota Motor Co., Morita Masanobu, attends a production technology course taught by Shigeo Shingo at Toyoda Automatic Loom. Morita Masanobu applies what he learned during the course and achieves striking results when they are applied at Toyota. As a result, Shigeo Shingo becomes one of the first consultants Toyota Motor Company hires. This marks the beginning of his in-depth involvement with Toyota and the Toyota Production System.
1955	Assumes control of industrial engineering and factory improvement training at the Toyota Motor Co. for both its employees and parts suppliers (100 companies). Is impressed by the separation of workers and machines while observing multiple machine operations at the first production technology training course at Toyota Motor Corp.

1956	Took charge of a three year study from 1956 to 1958 concerning ship building at Mitsubishi Shipbuilding's Nagasaki shipyards. During this study he implements his second revolutionary accomplishment by creating a system for hull assembly of 65,000 ton super-tankers after being told such a system would be impossible. Shigeo Shingo succeeds in cutting ship building time from four months down to two and in the process establishes a new world record. Within a year all ship yards in Japan are using his method.
1957	While at Mitsubishi Shipbuilding's Hiroshima shipyards he doubles the work rate of an engine bed planer by constructing a spare table. He conducts advance set-up operations on it and changes work piece and table together. This foreshadows a crucially decisive conceptual element of SMED, that of shifting internal activities to external activities.
1959	After 14 years with the Japan Management Association, Shigeo Shingo leaves to found the Institute of Management Improvement. The Institute is still in operation today.
1960-90	Dr. Shingo continued his work until a fully realized SMED system was developed. His system of achieving zero quality defects (poka-yoke) eventually saw some plant operations going over two years with *zero defects*. He continued working, consulting, and lecturing around the world until his death in 1990.

A Book Discussion on Kaizen and the Art of Creative Thinking

The following is a conversation between Norman Bodek, credited with being the 'Godfather of Lean', and David S. Veech, Executive Director of the Institute for Lean Systems in Louisville, Kentucky. The discussion centers on Dr. Shigeo Shingo's book, *Kaizen and the Art of Creative Thinking*.

BODEK: What David and I have in common is to teach people how to have an advanced suggestion system, a new way of getting people involved. This is the often-misunderstood element of Toyota's success—developing and empowering people to be creative on the job. This latest book by Dr. Shingo provides us with original insight into this creative element.

VEECH: I think the most important thing for managers to do is to teach their people how to solve problems.

BODEK: Ah, but you see, we don't often teach that do we?

VEECH: That's because we haven't taught our managers how to be teachers.

BODEK: Yes, and this is part of what Dr. Shingo's book is about. He has gone through and taken out the best ideas from all of the great teachers of continuous improvement and developed a thinking methodology, a step-by-step approach that he calls The Scientific Thinking Mechanism.

VEECH: What I think this book offers more than anything else is a window into how Dr. Shingo's mind actually worked; how he actually brought new thinking to different processes. Having that shared insight and additional information is priceless. Norman, you did the same thing when you published Taiichi Ohno's books like *Toyota Production System*. These books tell so

much about what the architects of the Toyota Production System actually did, and how they thought about what they did. It really reveals some of their hidden art.

The more understanding we have about the hidden art of these great thinkers, the more likely we are able to apply it ourselves.

BODEK: Dr. Shingo taught 3,000 Toyota engineers the fundamentals of process thinking, which he covers thoroughly in this book. Like Dr. Shingo, David, you are teaching a thinking system, or an idea system.

VEECH: I am. I'm teaching a suggestion system that comes partly from Maasaki Imai's work, Kaizen, and partly from the history of the Toyota Production System. But what I'm doing, what I'm teaching, is primarily that the new suggestion system is the teaching tool for problem solving skills for the workforce.

When you get somebody with a great idea, what you really have is someone who is ready and willing to learn. When they come in and tell you about their idea, they are the perfect vessel for learning. You've got their full involvement, their full engagement, and their full attention.

We as leaders in organizations can totally crush that by saying, "I don't have time for this right now," or even, "It's an okay idea." We can also crush it by having them fill out an overly complex suggestion form and sticking in a suggestion box. Or we can embrace our responsibility as teachers and listen to the idea, and let them do an internal analysis themselves of whether the idea is good or not.

And if they say, "You know, that's probably not a good idea," that's okay, because then they're going to go and refine it and they're going to come back to you.

So with a focus on what you and I are doing with Quick & Easy Kaizen, some of the organizations that we're working with are introducing simplified forms. The forms capture ideas quickly, and then the team member, with help either from peers, a team leader, or a specific coach, works through that idea himself rather

than sending the idea off to some black hole of engineering.

Dr. Shingo instructs us to keep the analysis, and hence the learning, at that team member level so they can have the benefit of going through that problem solving process and actually reaching a solution on their own.

BODEK: You just brought up something brilliant, two points we have to talk about and work on.

One is, 'that moment' a great learning moment for the manager and the worker. And if the manager looks at the worker and thinks, "How do we use this for the worker's education," that's the key. How do we look at this for the benefit and the growth of the worker?

That was brilliant but the next thing in this area is defining the ultimate role of the manager. The manager should really have only a few key roles, because a well-managed company needs less managing.

A Socio-Technical System, something Toyota is now slowly applying, doesn't need managers except as people that are visionaries to give direction. So what is the role of the manager in a lean system?

VEECH: It's to teach. And that doesn't mean we've got to pull people together in a classroom and show slides. It's interacting every day with folks doing the work.

BODEK: Just last week, I was at a plant and saw a worker at a powder coating operation. I looked and saw paint billowing out of the painting booth and all over the floor. I asked, "Why is that happening? It's making the place filthy and will get into everyone's lungs."

The worker replied, "Well, because there's a leak inside the booth."

And I asked him, "What can you do to fix it?"

He replied, "All we've got to do is solder it and cover it."

and saves their company $4000 per year from their ideas.

VEECH: I'm consulting at Skier's Choice, where they're using a Lean improvement activity sheet that simply identifies what the problem looks like before a solution is applied and then what it will look like after. It pretty much simplifies the suggestion system process.

Workers make a one–page suggestion report on the solutions they implement themselves based on the values of the company. So the company has spent time teaching the things that are important; ensuring before you make this change you check with the people who you're going to impact, and make sure that everybody gets a chance to have some input.

Our clients have done thousands of these. One even has a little low-hanging fruit tree in their building where people post ideas or problems. Others look at the ideas or problems, pick that "low hanging fruit" from the tree, and go implement the idea in their area, or solve the problem. It's just an encouraging way to foster better communications.

BODEK: We have to begin to really trust people, to give them an opportunity to learn every day on the job and to give the worker the responsibility to make the product right. If I make a mistake, I'm going to learn from that mistake. But management doesn't want me to make mistakes which is very shortsighted. Management might as well say, "Don't make mistakes—don't learn!"

You just opened something very powerful for us and we have to discuss it. How do we train managers to teach workers this process… this process of discovering the problems around them and giving them the opportunity to grow on the job from their implemented ideas?

VEECH: We've got to teach people how to think about what they're doing. It's not enough just to go in and tell people, "Well, you're empowered now. Think about your work, too."

You can't expect people to do anything unless you deliberately

teach them what they need to know.

That doesn't mean that you don't have a brilliant workforce already. You probably have folks that can do this without a second's delay. But in order to incorporate this thinking into a sustainable lean system, then you've got to have a structured way to teach, a structured way to support, and a structured way to implement.

BODEK: Dr. Shingo was always direct and uncomplicated. These models presented in the book are the missing link to driving this kind of success we are talking about today.

VEECH: It is brilliant, but I think some of your readers are going to be challenged by some of the stories in the book and say, "Well, I can see why Dr. Shingo decided to do the weld on one side of that washer plate and not both sides. But I make plastic parts. What does this have to do with me?"

And that's one of the points of resistance that we encounter all the time. "Yeah, that's great for those guys, but what about me? I'm different."

BODEK: Everybody says that. But, Dr. Shingo is trying to give us the foundational elements of problem solving; to take us through the four purposes of improvement, and the 12 steps of idea generation and he has delivered. I want to break this down very simply so that we go back to what you just said, which was so powerful. It is the manager's job to teach the worker how to think, how to grow from his own ideas, and to let the worker become their own teacher. In other words, let them grow from their own struggles.

We have to widen people's jobs. That's what a Socio–Technical System does. We have to widen people's roles and responsibilities and to have them understand more of the business. One of the most important roles the manager has is to bring out the best in people, or else we don't need managers. We need to help make superior people – they are superior as technicians on what they do but it is about growing that knowledge.

VEECH: We must have leaders designing systems that can draw learning energy from all team members. The role of a manager should be improving. Remember Imai's box? He's got improvement on top and maintenance on the bottom along with the amount of time people at various levels of the organization should spend on one versus the other. Senior managers should spend just about all of their time on improvement.

But what we have, especially in Western companies, are senior managers spending most of their time fire fighting, waiting for a problem to show up and then going out and solving the problem. And that's a big issue too, because we've got a whole generation of leaders and managers who think their job is to solve problems, when their actual job should be teaching the people who discovered those problems, how to solve it themselves.

And that, I think, is going to be the big one to overcome for us as a society.

BODEK: Well, we're going to do it. Mr. Ohno gave us a great statement; I started off talking about that today. Mr. Ohno said, "You only ask and you don't tell people what to do… even if you know the answer." This is what Socrates did as a teacher.

VEECH: You're right. The great teachers have always asked questions.

BODEK: If the manager's job is to be the problem solver, then he's going to be fully occupied solving problems. But if he disseminates this to every worker, then he has nothing to do with solving problems, other than to teach workers how to do it. This is the real essence of Toyota's success.

VEECH: We learned at the Toyota North American Kaizen Conference that the three most important tools in Kaizen are string, cardboard, and tape. An operator can do anything with string, cardboard, and tape; they can make something and make mistakes without spending a ton of money. They can redo things, model things, try things out, and experiment. Once you get the design right, then you send it off to the engineering team and

they can make something out of sheet metal or something like that.

BODEK: Let's keep moving forward on this, because managers today still feel that they're paid to be problem solvers. They don't want to give up their turf; they're afraid.

VEECH: I think the problem there is that most managers don't know the work well enough to be effective problem solvers because they're so detached from the actual work. Even the good ones who go out and have great relationships with their employees still don't have that intimate knowledge of what is an effective solution. Even though we have made these managers expect to have this role of problem solver, they're not really the right people. So we've got to get them to engage the workforce, where the skill really is, where the people really know what the problems are and which solutions will work. We must develop that link with the people who are actually doing the work.

BODEK: To what extent is it still applied at Toyota today?

VEECH: My most detailed knowledge comes from the Georgetown plant, of course, where I have many colleagues and friends who still work there. After much observation, I think the largest challenge is too many team leaders working the floor every day instead of being team leaders. They're not coaches anymore, they become production workers. They're fully engaged in productive work leaving little time to focus on improvement.

I was at Power Train (Toyota's Engine Plant in Georgetown) a few months ago and got to walk through a couple of operations with one of the employees, and he showed me some of the things that they were doing internally. I know the people are still engaged, they are still highly skilled, and their leaders are listening to them. So that's already a big plus.

What I recommend for anybody who wants to try this out is to run a participation-focused suggestion system for at least five years. I know nobody wants to wait that long but you are build-

ing a sustainable model and it takes time.

At Georgetown they started in 1989. In 1994, they had a 96% participation rate. The numbers of raw ideas kept going up until 1999, but their participation rate never hit 96% again. At that maximum participation rate, companies need to tweak the suggestion system to focus on something different.

The idea is to change the focus from participation, where you're trying to teach everybody how to navigate the system, to one on learning, where you have to have more challenging problems. This means you're going to have a more restrictive suggestion system. Fewer things are going to be eligible for the rewards and benefits of the suggestion system, but it's still going to be focused on problems that team members can solve.

BODEK: You keep it simple. People are excited and the focal point is on growing. If people understand this, the idea system could be the beginning of their college education. You just ask your team members, give them an actual support system and they'll run with it. I like what we're doing, David, because of what the this system does; it provides a college education on the job. They have the opportunity to grow on the job.

David, tell us why you think this book is so valuable to America.

VEECH: I think this book is valuable because it shows us more about how to think, in a systematic method, about our work. It also demands that we really know what's going on. Most of us assume that we do… but we don't. This book keeps it simple and straightforward, and if people recognize the power of asking questions and asking for help, then there are no limits to the creativity and energy you can create in your workforce.

BODEK: This is really what's missing but thankfully Dr. Shingo provides us with an answer on how to structure the improvement process so it will go forward within a company. We've never addressed that level before. We've been provided with specific tools like SMED, 5S, JIT, and TPM, but we've never been

with one company, and all they can think about is profits, and the company is melting and disappearing, instead of focusing on the process. Focus on the right process, and you get the right results.

Let's look at Dr. Shingo's Analytical Thinking Diagram for a few moments.

VEECH: I understand that the subject is who, the object is what we're looking for, the method is how, the space is where and the time is when. Toyota still uses this simple organizational tool they call the 5 W's and 1 H. What's missing, and what I think Dr. Shingo is trying to capture in the diagram, is why. I think, though, that it's part of avoiding ambiguities—understanding a little bit more. That takes us back to knowing instead of guessing.

I think Dr. Shingo is trying to say that we lack the quantitative knowledge of who is actually affecting what, so we obscure the subject and the object of the problem. And if your definition of the subject and the object is not truly accurate, it doesn't matter what method or what constraints there are, you're going to get a bad solution. The problem is going to come back.

I think what he succeeds most at is showing us how to clearly communicate quantitatively. We must have true knowledge of the subject and object, not just guesses, not just assumptions. We've really got to know that.

BODEK: That's why he says we have to avoid ambiguity, we must have true knowledge.

VEECH: Dr. Shingo also talks about 4 purposes of improvement, listing them as 1) Increasing productivity, 2) Improving quality, 3) Cutting time, and 4) Cutting cost. If we can make our team members' work more interesting or easier, we are very likely to achieve all four of these purposes of improvement. If we can do that AND improve the problem solving skills of those same team members, now we have sustainable improvement. This requires that we focus again on process not on results.

We have to acknowledge the most important processes are the ones we adopt as our standard approach to problem solving. We build this into our standardized work system, so that every time someone has an idea, they go through this process of analysis, synthesis, and evaluation. It doesn't have to be complicated and it doesn't have to be time-consuming. But it does have to begin with the team members, who need the skill and the confidence to start sharing their ideas. We still have a long way to go, but a book like this definitely provides direction.

List of Figures

Chapter One

Chapter Two

Chapter Three

Chapter Six

List of Tables

Chapter One

Chapter Two

Chapter Three

Chapter Four

Chapter Five

INDEX

SYMBOLS

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

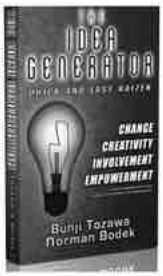
W

Publications from Enna and PCS Inc.

Enna and PCS Inc. provide companies with publications that help achieve excellence in operations. Enna and PCS Inc. support your efforts to internalize process improvement allowing you to reach your vision and mission. These materials are proven to work in industry. Call toll-free (866) 249-7348 or visit us on the web at www.enna.com to order or request our free product catalog.

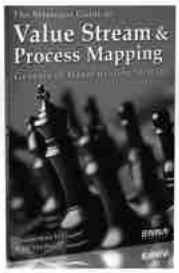
Training Materials and Books

The Idea Generator, Quick and Easy Kaizen



The book discusses the Kaizen mind set that enables a company to utilize its resources to the fullest by directly involving all of its manpower in the enhancement and improvement of the productivity of its operations.
ISBN 978-0971243699 | 2001 | $47.52 | Item: **902**

The Strategos Guide to Value Stream & Process Mapping



The Strategos Guide to Value Stream and Process Mapping has proven strategies and helpful tips on facilitating group VSM exercises and puts VSM in the greater Lean context. With photos and examples of related Lean practices the book focuses on implementing VSM, not just drawing diagrams and graphs.
ISBN 978-1-897363-43-0 | 2007 | $47.00 | Item: **905**

Quick and Easy Kaizen Training Package

Quick and Easy Kaizen is the most effective and powerful way to implement a practical and sustainable employee-led improvement system by encompassing the often-ignored human (employee) side of Lean manufacturing. Enna's Quick and Easy Kaizen is authored by Norman Bodek and made popular by his award winning Shingo Prize book, *Quick and Easy Kaizen: The Idea Generator*.
ISBN 978-1-897363-37-9 | 2006 | $699.99 | Item: **18**

Tel: (866) 249-7348 Fax: (905) 481-0756 Web: info@enna.com

Kaikaku, The Power and Magic of Lean

Kai ka ku are Japanese characters meaning a 'transformation of the mind,' Norman Bodek brings his vast cross-cultural experience in Japanese manufacturing systems to American industry and creates proven results. With his first-hand knowledge of Lean Manufacturing origins, Norman Bodek chronicles his introduction to Lean in an easy to read, conversational style text.

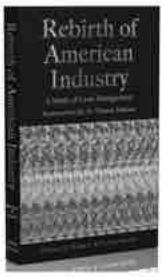
ISBN 978-0971243668 | 2006 | $47.52 | Item: **901**

JIT is Flow

Hirano's *5 Pillars of the Visual Workplace* and *JIT Implementation Manual* were classics. They contained detailed descriptions of techniques and clear instructions. However, Hirano's books were difficult to adapt to many sectors. This book highlights the depth of the thought process behind Hirano's work. The know-how that is contained in this book is extremely useful. The clarity which Hirano brings to JIT/Lean and the delineation of the principles involved will be invaluable to every leader and manager aiming for business excellence.

ISBN 978-0971243613 | 2006 | $47.52 | Item: **903**

Rebirth of American Industry



We had a certain amount of sadness as we read of the bankruptcy of Delphi Corporation, and the losses and downsizing of General Motors and Ford. The very purpose of this book is to provide modern managers with specific guidelines to be internationally competitive. The book traces the evolution of manufacturing management along two lines: That pioneered by Henry Ford, then furthered by Toyota to its modern level of success; versus that originated by Alfred Sloan and others at General Motors still in practice in most American companies today.

ISBN 978-0971243637 | 2005 | $47.52 | Item: **904**

All You Gotta Do Is Ask

So, after all the committees, review panels, and head scratching, your company has finally started its Lean transformation. *All You Gotta Do Is Ask* explains how to promote a tidal swell of ideas from your employees. This easy-to-read book will show you why it is important to have a good idea system, how to set one up, and what it can do for you, your employees, and your organization.

ISBN 978-0971243651 | 2005 | $47.52 | Item: **906**

To order: Enna Products Corp. 1602 Carolina St., Unit B3, Bellingham, WA 98229

Overview of Lean Training Package

This package has been designed to create the understanding needed to commit to a Lean Transformation. Make the most of our introductory Lean package by training all your staff in the principles of Lean Manufacturing. Included with this package is a factory flow simulation exercise to demonstrate the concepts of Lean in a real-time exercise. This comprehensive training package is action oriented to ensure successful learning and communication of Lean Manufacturing principles.
ISBN 978-0-973750-92-8 | 2006 | $349.99 | Item: **11**

5S Training Package

Our 5S Solution Packages will help your company create a sustainable 5S program that will turn your shop floor around, and put you ahead of the competition. All of the benefits that come from Lean Manufacturing are built upon a strong foundation of 5S. The success or failure of all improvement initiatives can be traced to the robustness of 5S programs. Enna's solution packages will show you how to implement and sustain an environment of continuous improvement.

Version 1: ISBN 978-0-973750-90-4 | 2005 | $429.99 | Item: **12**
Version 2: ISBN 978-1-897363-25-6 | 2006 | $429.99 | Item: **17**
Version 1: Sort, Straighten, Sweep, Standardize, and Sustain.
Version 2: Sort, Set In Order, Shine, Standardize, and Sustain

To Order:

Phone, fax, email, or mail to Enna Products Corporation ATTN: Order Processing, 1602 Carolina Street, Unit B3, Bellingham, WA, 98229 USA. Phone: (866) 249-7348, Fax: (905) 481-0756, Email: info@enna.com. Send checks to this address. We accept all major credit cards.

International Orders:

Phone, fax, email, or mail to Enna Products Corporation ATTN: Order Processing, 1602 Carolina Street, Unit B3, Bellingham, WA, 98229 USA. For international calls, Telephone number: +1 (360) 306-5369, Email: info@enna.com, and Facsimile number: +1 (905) 481-0756.

Notice:

All prices are in US dollars and are subject to change without notice.

Kaizen and The Art of Creative Thinking

"This book will help you understand the deep thinking that underlies the real practice of TPS. We are fortunate to have this new opportunity to gaze deeply into the thinking of one of the true geniuses behind TPS—Dr. Shigeo Shingo."

Jeffrey K. Liker, Ph.D., Professor, Industrial and Operations Engineering
University of Michigan, Ann Arbor

"Dr. Shingo's book is a goldmine of improvement ideas that cumulatively must have saved companies millions, and will still do so today!"

Don Dewar, President & Founder
Quality Digest Magazine

"Dr. Shingo's Scientific Thinking Mechanism replaces the hope for creativity with a reliable and learnable habit-building approach. Thank you for making this Rosetta Stone of Kaizen available to the world."

Hal Macomber, Principal
Lean Project Consulting, Inc.

"This is a revealing book and is the genesis of the Lean Manufacturing mindset—truly a wealth of knowledge and wisdom to embolden you to change existing practices!"

Michel Mestre, Ph.D., Professor, School of Business
Northwest University, Kirkland

ISBN 978-1-897363-59-1
55940 >
9 781897 363591

ENNA
KNOWLEDGE INTO PRACTICE
PCS Press