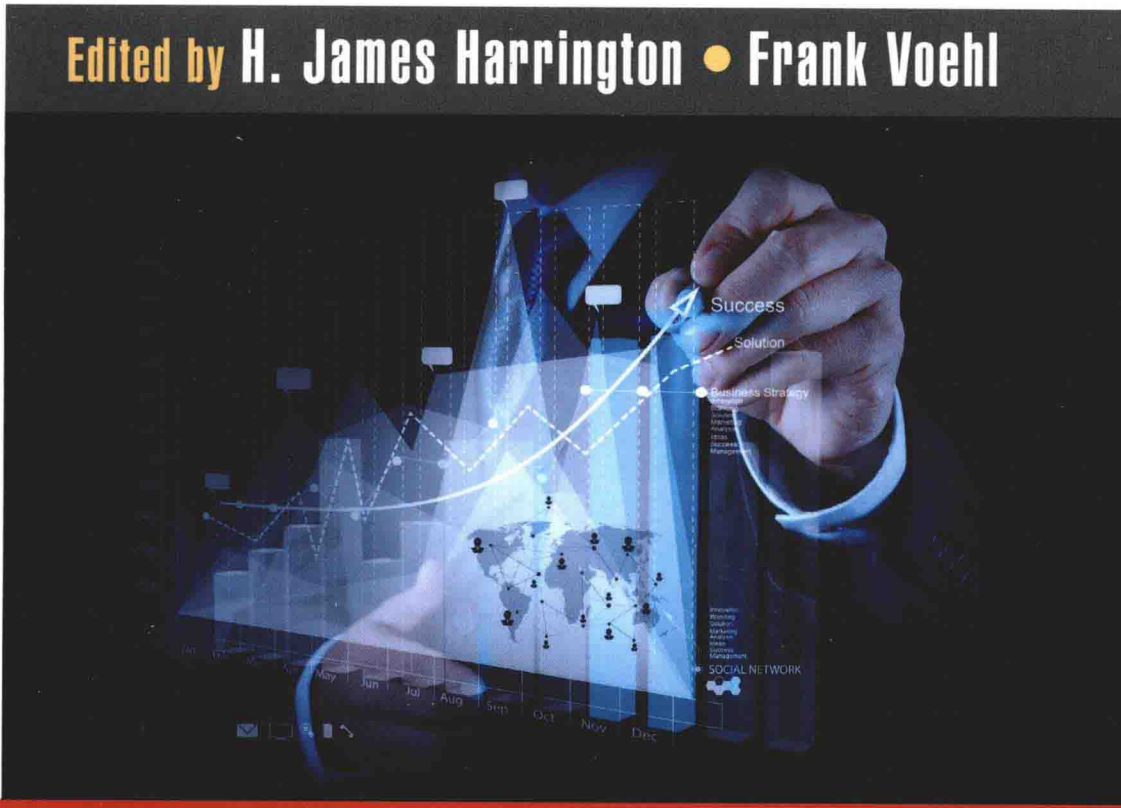
Volume 2

The Innovation Tools Handbook

Evolutionary and Improvement Tools That Every Innovator Must Know

Edited by H. James Harrington • Frank Voehl



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IAOIP
INTERNATIONAL ACADEMY for QUALITY

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Volume 2

The Innovation Tools Handbook

Evolutionary and Improvement Tools That Every Innovator Must Know

I dedicate this book to my son, Jim. As I have grown older I rely more and more on him to keep things running smoothly. In spite of his heavy workload (many nights he is still working at 3 a.m.), he always finds time to call me every evening to be sure I'm okay and wish me good night. Two or three times a week he breaks loose from his normal work schedule to bring me my dinner and spend the evening with me watching television. I thank God that he gave me such a loving and caring son. He really is the sunlight in my life.

H. James Harrington

I dedicate this book to Dr. Myron Tribus, the father of the Quality Council Innovation Movement, who is both a friend and a very powerful influence in my life. He never met a problem he couldn't solve, nor a conundrum he couldn't puzzle out—a deep thinker who taught me that "thinking about thinking" was a goal to be sought after. Thank you for teaching us how to be innovative and to use our creativity for the betterment of man and the world around us.

Frank Voehl

Foreword

This book is part of a three-book series designed to provide its readers with the tools and methodologies that all innovators should be familiar with and able to use. These are the output from the Tools and Methodologies Working Group of the International Association of Innovative Professionals (IAOIP). The working group was made up of the following individuals:

- H. James Harrington, chairman
- Frank Voehl, co-chairman
- Yared Akalou
- Sifer Aseph
- Scott Benjamin
- Carl Carlson
- Gul Aslan Damci
- Richard Day
- Lisa Friedman
- Thomas Gaskin
- Dallas Goodall
- Luis Guedes
- Paul Hefner
- Dana Landry
- Elena Litovinskaia
- Nikolaos Machairas
- Thomas Mazzone
- Chad McAllister
- Pratik Mehta
- Dimis Michaelides
- Howard Moskowitz
- Michael Phillips
- Jose Carlos Arce Rioboo
- Achmad Rundi
- Robert Sheesley
- Max Singh
- Nithinart Sinthudeacha
- Henryk Stawicki
- Maria Thompson
- Hongbin Wang
- David Wheeler
- Jay van Zyl

The mission statement for the Tools and Methodology Working Group is

Using the expertise and experience of the organization's members and literature research, the working group will define the tools and methodologies that are extensively used in support of the innovation process. The working group will narrow the comprehensive list of tools and methodologies to a list of the ones that are most frequently used in the innovative process and which are the ones that innovative professionals should be confident in using effectively. For each tool and methodology, the working group will prepare a write-up that includes its definition, when it should be used, how to use it, examples

of how it has been used, and a list of 5 to 15 questions that can be used to determine if an individual understands the tool or methodology.

To accomplish this mission, the working group studied the literature that was available to define tools and methodologies that were proposed or being used. They also contacted numerous universities that are teaching classes on innovation or entrepreneurship to determine what tools and methodologies they were promoting. In addition, they contacted individual consultants who are providing advice and guidance to organizations in order to identify tools and methodologies they were recommending. As a result of this research, a list of more than 200 tools and methodologies was identified as being potential candidates for the innovative professional.

The group then sent surveys out to leading innovative lecturers, teachers, and consultants, asking them to classify each tool or methodology into one of the following categories:

- This tool or methodology is used on almost all the innovation projects = 4 points.
- This tool or methodology is used on a minimum of two out of five innovation projects = 1 point.
- This tool or methodology is seldom if ever used on innovative product projects = 0 point.
- Not familiar with the tool or methodology = −1 point.
- Never used or recommend this tool or methodology in doing innovation projects = −4 points.

We calculated the priority for each of the tools/methodologies by assigning a point value for each answer. The guidelines that we followed are

- Plus 4 points for a tool/methodology that was always used.
- Plus 1 point for a tool/methodology that is being used at least two out of five projects.
- No points for a tool/methodology that was seldom used.
- Minus 1 for a tool/methodology that the expert had never heard of.
- Minus 4 points for a tool/methodology that the expert never used.

Our goal was to define 50 of the most effective or most frequently used tools/methodologies by the innovative practitioner. We ended up

with the 76 tools/methodologies that are the most effective or the most frequently used tools/methodologies by the innovative practitioner (professional).

We then submitted the selected 76 tools/methodologies to a group of 28 practicing innovators, asking them to write a chapter on one or more of the tools/methodologies.

When we assembled the 76 chapters, we ended up with a manuscript of about 1000 pages. After a discussion with the book's editors and key people in the Tools and Methodologies Working Group, it was decided to divide the book up into the following three books:

- Creative tools/methodologies that every innovator should master
- Evolutionary or improvement tools/methodologies that every innovator should master
- Organizational/operational tools/methodologies that every innovator should master

On the basis of these three breakdowns, we went out again to innovative experts asking them to classify each tool as falling into one of the three categories. We soon realized that many of the tools were used in more than one category, so we asked the experts to classify the category that the tool is primarily used in and indicate which categories the tool/methodology could also be used in. Based on this study, we divided the manuscript into three books:

- *Organizational and Operational Tools, Methods, and Techniques That Every Innovator Must Know*
- *Evolutionary and Improvement Tools That Every Innovator Must Know*
- *Creative Tools, Methods, and Techniques That Every Innovator Must Know*

Each book contains the tools/methodologies that were rated as primarily used in that category. The results of this study can be seen in Table F.1.

Genrich Altshuller, the father of TRIZ, did something similar when he analyzed 200,000 patents to determine what unique thought patterns were used to generate the unique patentable idea. On the basis of his study of patents and technological systems, Altshuller proposed that five levels of invention exist:

TABLE F.1

List of the Most Used and/or Most Effective Innovative Tools and Methodologies in Alphabetical Order

Volume 1: Organizational and/or Operational IT&M

Volume 2: Evolutionary and/or Improvement IT&M

Volume 3: Creative IT&M

	IT&M	Volume 3	Volume 2	Volume 1
1.	5 Why questions	S	P	S
2.	76 Standard solutions	P	S	
3.	Absence thinking	P		
4.	Affinity diagram	S	P	S
5.	Agile innovation	S		P
6.	Attribute listing	S	P	
7.	Benchmarking		S	P
8.	Biomimicry	P	S	
9.	Brainwriting 6–3–5	S	P	S
10.	Business case development		S	P
11.	Business plan	S	S	P
12.	Cause-and-effect diagrams		P	S
13.	Combination methods	P	S	
14.	Comparative analysis	S	S	P
15.	Competitive analysis	S	S	P
16.	Competitive shopping		S	P
17.	Concept tree (concept map)	P	S	
18.	Consumer co-creation	P		
19.	Contingency planning		S	P
20.	CO-STAR	S	S	P
21.	Costs analysis	S	S	P
22.	Creative problem solving model	S	P	
23.	Creative thinking	P	S	
24.	Design for tools		P	
	Subtotal—Number of Points	7	7	10

(*Continued*)

TABLE F.1 (CONTINUED)

List of the Most Used and/or Most Effective Innovative Tools and Methodologies in Alphabetical Order

Volume 1: Organizational and/or Operational IT&M

Volume 2: Evolutionary and/or Improvement IT&M

Volume 3: Creative IT&M

	IT&M	Volume 3	Volume 2	Volume 1
25.	Directed/focused/structure innovation	P	S	
26.	Elevator speech	P	S	S
27.	Ethnography	P		
28.	Financial reporting	S	S	P
29.	Flowcharting		P	S
30.	Focus groups	S	S	P
31.	Force field analysis	S	P	
32.	Generic creativity tools	P	S	
33.	HU diagrams	P		
34.	I-TRIZ	P		
35.	Identifying and engaging stakeholders	S	S	P
36.	Imaginary brainstorming	P	S	S
37.	Innovation blueprint	P		S
38.	Innovation master plan	S	S	P
39.	Kano analysis	S	P	S
40.	Knowledge management systems	S	S	P
41.	Lead user analysis	P	S	
42.	Lotus blossom	P	S	
43.	Market research and surveys	S		P
44.	Matrix diagram	P	S	
45.	Mind mapping	P	S	S
46.	Nominal group technique	S	P	
47.	Online innovation platforms	P	S	S
48.	Open innovation	P	S	S
49.	Organizational change management	S	S	P
50.	Outcome-driven innovation	P		
	Subtotal—Number of Points	15	4	7

(Continued)

TABLE F.1 (CONTINUED)

List of the Most Used and/or Most Effective Innovative Tools and Methodologies in Alphabetical Order

Volume 1: Organizational and/or Operational IT&M

Volume 2: Evolutionary and/or Improvement IT&M

Volume 3: Creative IT&M

	IT&M	Volume 3	Volume 2	Volume 1
51.	Plan–do–check–act	S	P	
52.	Potential investor present	S		P
53.	Pro-active creativity	P	S	S
54.	Project management	S	S	P
55.	Proof of concepts	P	S	
56.	Quickscore creativity test	P		
57.	Reengineering/redesign		P	
58.	Reverse engineering	S	P	
59.	Robust design	S	P	
60.	S-curve model		S	P
61.	Safeguarding intellectual properties			P
62.	SCAMPER	S	P	
63.	Scenario analysis	P	S	
64.	Simulations	S	P	S
65.	Six Thinking Hats	S	P	S
66.	Social networks	S	P	
67.	Solution analysis diagrams	S	P	
68.	Statistical analysis	S	P	S
69.	Storyboarding	P	S	
70.	Synetics	S	S	P
71.	Systems thinking	P		
72.	Tree diagram	S	P	S
73.	TRIZ	P	S	
74.	Value analysis	S	P	S
75.	Value propositions	S		P
76.	Visioning	S	S	P
	Subtotal—Number of Points	7	12	7

(P) Priority Rating	**Creative**	**Evolutionary**	**Organizational**
Total	29	23	24

IT&M in creativity book: 29
IT&M in evolutionary book: 23
IT&M in organizational book: 24

Note: IT&M, innovative tools and/or methodologies; P, primary usage; S, secondary usage; blank, not used or little used.

- Level 1—Apparent solution
  - Level 1 inventions are obvious and apparent solutions involving well-known methods and knowledge requiring no new invention of any consequence. These are developed based on evolutionary-type thinking patterns.
- Level 2—Minor improvement
  - Level 2 inventions constitute minor nonobvious improvements to a system, using methods known within the domain of discourse but applied in a new way. These are developed based on mostly evolutionary-type thinking patterns.
- Level 3—Major improvement
  - Level 3 inventions involve fundamental improvements to a system involving methods known outside of the domain. This involves applying an idea to the domain that has never been used in the domain previously. These are primarily developed using unique and creative thinking patterns.
- Level 4—New paradigm
  - Level 4 inventions entail the development of an entirely new operating principle and represent radical changes. These are developed using highly creative thinking patterns.
- Level 5—Discovery
  - Level 5 inventions represent a rare scientific discovery or the pioneering of totally new industry altogether. These are developed on the basis of previously untapped concepts and accidental results.

See Figure F.1, which shows the results of Altshuller's analysis.

We were personally surprised to learn that with all of today's focus on creativity and innovation that more than 95% of the patentable ideas are evolutionary in nature and that less than 5% of the patentable ideas are truly creative.

We believe by making effective use of the tools and methodologies presented in this book that an organization can increase the percentage of creative/innovative ideas by five to eight times its present performance level. It is possible; others have done it. It is now up to you to make use of these effective and efficient innovative organizational/operational tools and methodologies.

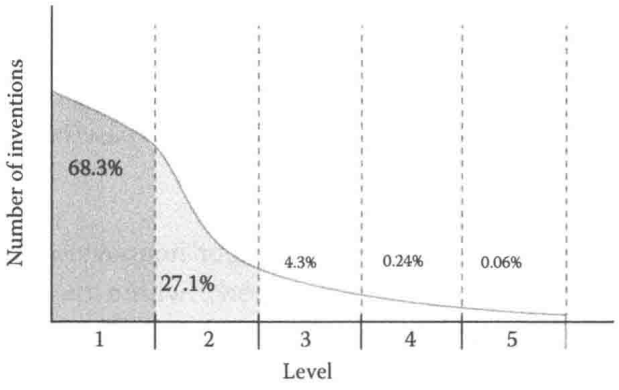

FIGURE F.1
Breakdown of percentage of patents that were developed in each of the five creative classifications.

We are presenting the following 23 tools/methodologies related to innovative evolutionary products, processes, and services, or to improve existing ones.

5 Why questions
Affinity diagrams
Attribute listing
Brainwriting 6–3–5
Cause-and-effect diagrams
Creative problem solving model
Design for tools
Flowcharting
Force field analysis
Kano analysis
Nominal group technique
Plan–do–check–act
Reengineering/redesign
Reverse engineering
Robust design
SCAMPER
Simulations
Six Thinking Hats
Social networks
Solution analysis diagrams
Statistical analysis
Tree diagram
Value analysis

We are certainly not advocating that you need to use all 23 in order to have an innovative culture. Quite the contrary—the innovator needs to understand all 23, how they are used, and the type or results that they bring about in order to select the right combination for the specific organization they are working with.

H. James Harrington

Preface

In today's fast-moving and high-technology environment, the focus on quality has given way to a focus on innovation. Quality methodology has been shared and integrated into organizations around the world. High quality is now a given for products and services produced in Japan, United States, Germany, Italy, China, India—yes, everywhere. Competition is more fierce and intense than ever before. Technology breakthroughs can be transferred to any part of the world in a matter of days. The people trained in schools around Shanghai are better educated than the people graduating in San Francisco or New York City. The key to being competitive is staying ahead of the competition. That means coming out faster and with more competitive products and services than the competition. The problem that every organization has, be it public or private, profit or nonprofit, product or services, is a need to have more innovative ideas effectively implemented. Today, we need to have our people generate more and better innovative ideas that can be rapidly provided to the consumer. That means that every part of the organization needs to be involved in the innovative activities. Innovative ideas cannot come from just research and development alone. We need to have more innovative processes and systems to support finance, production, sales, marketing, personnel, information technology, procurement—yes, every part of the organization. Even the person sweeping the floors can come up with an innovative idea that will drive a new product cycle. Organizations used to expect their employees, when they came to work, to stop thinking and blindly follow instructions. Today, employees need to realize that they are being paid for both their physical and mental capabilities. Our employees have to understand that if they are going to get ahead, they are now required to be more creative and more innovative at work than any place else. When they get to work, everyone needs to take off their baseball cap and put on their thinking hat in order for the organization to be successful. Today, the best worker is the best thinker, not the one who moves the most products.

Everybody is talking about the importance of innovation, how innovative they are, what innovative products they are producing, and how they need to be more innovative. Everybody is using the word *innovation*

to highlight why they are different from everyone else, why customers should rely on them to provide services and product. But what does it all mean? After years of discussion, arguments, and debates, there is little agreement on what a true definition of innovation is. At one extreme, people will argue that innovation is "any new and unique idea." At the other extreme, individuals will define innovation as "a new and unique idea that is produced and delivered to an external customer who is willing to pay more for it than the cost to provide it plus a reasonable profit margin for the supplier." If you use the first definition of innovation, almost all organizations are innovative organizations. If you use the second definition of innovation, less than 5% of the organizations could be considered innovative. Over 95% of all new and unique ideas and suggestions that come from within most organizations never see the light of day; in other words, they never reach the final stage of 'deliverables to the customer.' Accordingly, they never generate a profit for the organization. My preferred definition that may or may not be in keeping with your personal beliefs is, "the process of translating an idea or invention into an intangible product, service, or process that creates value for which the consumer (the entity that uses the output from the idea) is willing to pay more for it than the cost to produce it."

Just so there is no confusion between innovation and creativity, creativity is defined as follows:

- *Creative*—Using the ability to make or think of new things involving the process by which new ideas, stories, products, etc., are created.
- *Create*—Make something; to bring something into existence.

The difference between creativity and innovation is that the output from the innovation has to be a value-added output, while the output from creativity does not have to be value added.

Keeping this information in mind, you can grasp the problem that the International Association of Innovation Professionals (IAOIP) was faced with when they were assigned the responsibility for (a) defining the body of knowledge for innovation and (b) establishing a certification program for innovators. It is obvious that before you can establish a body of knowledge for innovation, you have to have an accepted definition of innovation. Moreover, before you can certify an individual as the innovator, you have to be able to define what an innovator is and does.