

**TRIZ – Systematic Innovation in Manufacturing: Book Review****Wan Akmal Izzati Wan Mohd Zawawi<sup>a</sup>, Mazura Jusoh<sup>b\*</sup>, Jaysuman Pusppanathan<sup>c</sup>**<sup>a</sup>*Centre for Engineering Education, Universiti Teknologi Malaysia, 81310, UTM Skudai, Johor, Malaysia*<sup>b</sup>*Institute of Bioproduct Development, Universiti Teknologi Malaysia, 81310, UTM Skudai, Johor, Malaysia*<sup>c</sup>*Sports Innovation & Technology Centre (SITC), Institute of Human Centered Engineering (iHumEN), Universiti Teknologi Malaysia, 81310 Skudai Johor.**\*r-mazura@utm.my***Article history**

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**Abstract**

"TRIZ - Systematic Innovation in Manufacturing" is a comprehensive guide unveiling the transformative potential of the Theory of Inventive Problem Solving (TRIZ) within manufacturing contexts. This insightful book delves into the core principles of TRIZ, equipping professionals and engineers with a structured approach to tackle intricate challenges and drive innovation. Offering a blend of theory and practical applications, the book elucidates TRIZ methodologies through illustrative case studies, examples, and exercises tailored to the manufacturing sector. It navigates through inventive principles and contradiction resolution strategies, showcasing TRIZ's efficacy in optimizing processes, enhancing designs, and overcoming operational bottlenecks. While potentially challenging for those new to TRIZ, this resource serves as an invaluable asset for professionals seeking inventive solutions and systematic problem-solving approaches within manufacturing environments.

**Keywords:** Innovation in Manufacturing, Engineering Contradiction, Engineering System, Engineering Education

**Introduction**

"TRIZ - Systematic Innovation in Manufacturing" is an illuminating guide that unveils the power of the Theory of Inventive Problem Solving (TRIZ) within the manufacturing landscape. Authored by Yeoh Teong San, Yeoh Tay Jin, and Song Chia Li, this book stands as a comprehensive resource for professionals, engineers, and innovators seeking to revolutionize their approach to problem-solving and innovation.

At its core, the book delves deep into TRIZ methodology, elucidating its principles, tools, and practical applications within the manufacturing sector. It offers a structured framework for identifying and overcoming complex technical challenges, stimulating inventive thinking, and fostering a systematic approach to innovation.

One of the book's strengths lies in its ability to bridge theory with real-world implementation. It seamlessly integrates TRIZ concepts with manufacturing scenarios, providing numerous case studies, examples, and practical exercises, including STEM education (Abdul Rahim, 2020). These serve as invaluable aids in understanding how TRIZ can be effectively applied to resolve intricate issues and drive innovation in manufacturing processes.

Moreover, the authors adeptly demonstrate how TRIZ transcends conventional problem-solving methods. By highlighting the inventive principles and contradiction matrix, they showcase how seemingly contradictory aspects can be leveraged to unearth ingenious solutions, optimize product designs, improve processes, and reduce costs within manufacturing environments.

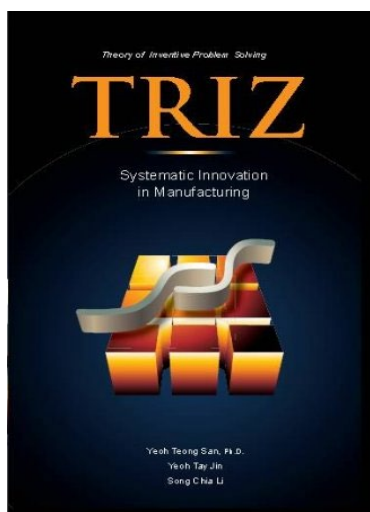
However, for readers new to TRIZ, the book's depth of technical content might pose a slight challenge, requiring careful attention and gradual assimilation of concepts.

This ingenious book serves as an indispensable guide for those aiming to elevate their problem-solving capabilities and drive innovation within the manufacturing realm. It is a testament to the efficacy of TRIZ methodologies in unlocking inventive solutions, positioning itself as an invaluable asset for professionals seeking to transform challenges into opportunities within the manufacturing landscape.

TRIZ is a systematic innovation methodology. The book very well explain it as a structured methodology for modelling the problem, tools to work with the models, and finally models of solutions for breakthrough idea generation. TRIZ is a recognized

international science of creativity, based on the laws of physics and innovative patents distilled to numerous problem-solving tools. It is a toolbox that provides users with methods to create breakthrough ideas. This book was written to enable an in-depth understanding of the philosophy, methodology, and tools used. In addition, the application of TRIZ in manufacturing (using semiconductor manufacturing examples) will further illustrate the power of TRIZ in providing a systematic approach from problem identification to innovative solution generation.

The book (Figure 1) acts as a valuable resource for beginners exploring TRIZ, offering foundational knowledge and touching on advanced tools while outlining TRIZ's overarching philosophy. Its primary strength lies in an abundance of manufacturing-specific case studies and examples, catering specifically to TRIZ practitioners, and providing compelling insights and practical applications within the manufacturing domain.



**Figure 1. TRIZ - Systematic Innovation in Manufacturing Book Cover**

**Structure and Content**

The structure and content of the book were carefully designed to enable systematic comprehension by its readers. The chapters of the book are detailed in Table 1. The book provides valuable technical knowledge not only for mastering TRIZ, but also for developing innovative strategies and ideas for solving problems. For instance, the manufacturing case studies depicted in Chapter 8 offer practical ways to enable good visualizations of how TRIZ can be applied. The three appendices list down all the 39 System Parameters, Contradiction Matrix, and 76 Standard Inventive Solutions that are required for TRIZ application.

**Table 1. Chapters offered in the book**

Chapters	Chapter Title
1	Introduction
2	TRIZ Problem Solving Process
3	Overview of TRIZ Models and Tools
4	Function Analysis
5	Product Analysis
6	Cause & Effect Chain Analysis
7	Trimming
8	Contradictions
9	Manufacturing Case Studies
10	Substance-Field Model
11	ARIZ
12	Summary
Appendix A	39 System Parameters
Appendix B	Contradiction Matrix
Appendix C	76 Standard Inventive Solutions

**Advantages of This Book**

"TRIZ - Systematic Innovation in Manufacturing" presents several strong points that make it an invaluable resource:

*Structured Approach:* The book provides a systematic framework for problem-solving and innovation within manufacturing. It offers a structured methodology through TRIZ principles, aiding engineers and professionals in approaching complex problems methodically.

*Practical Application:* It seamlessly integrates theory with practical examples and case studies specific to the manufacturing industry. This application-centric approach assists readers in understanding how TRIZ can be effectively utilized in real-world scenarios.

*Inventive Principles:* It effectively illustrates inventive principles and contradiction resolution strategies, showcasing how these principles can be applied to enhance product designs, streamline processes, and overcome technical obstacles in manufacturing.

*Problem-Solving Tools:* The book offers a rich array of problem-solving tools and methodologies tailored to the manufacturing sector. These tools empower readers to identify and address challenges innovatively, leading to enhanced efficiency and creativity in problem-solving.

*Insightful Guidance:* Authored by experts in the field, the book provides insightful guidance, offering a wealth of knowledge and practical insights that professionals can apply directly within their manufacturing environments.

**Educational Theories Related to TRIZ Application**

This book intersects with several educational theories, enhancing its relevance within educational

contexts, particularly in fostering problem-solving skills and innovation within engineering education.

One prominent educational theory connected to the book is Constructivism. TRIZ aligns with Constructivist principles by emphasizing active learning and the construction of knowledge through experience. It encourages learners, in this case, engineering students, to actively engage with problem-solving methodologies, allowing them to construct their understanding of inventive problem-solving processes. By presenting case studies, practical examples, and tools within the book, TRIZ facilitates a learning environment where students can construct their problem-solving skills by actively engaging with TRIZ methodologies.

Another pertinent theory associated with the book is the Experiential Learning Theory by David Kolb. TRIZ's emphasis on practical application aligns with Kolb's theory, which posits that learning occurs through concrete experiences. TRIZ encourages learners to engage in hands-on problem-solving exercises, analyze real-world scenarios, and apply TRIZ principles to solve manufacturing challenges. This experiential approach allows engineering students to reflect on their experiences, generalize their learnings, and apply them to novel situations—a core aspect of Kolb's theory.

Furthermore, the book resonates with aspects of Problem-Based Learning (PBL). TRIZ offers a problem-centered approach where students are confronted with authentic engineering problems and guided through structured methodologies to resolve them (Jiang et al., 2015). This approach mirrors the principles of PBL, fostering student-centered learning, critical thinking, and collaboration. By presenting practical problems and guiding learners through inventive solutions, TRIZ aligns with the PBL approach, encouraging students to explore solutions collaboratively and develop a deeper understanding of engineering problem-solving processes.

Overall, the book's incorporation of Constructivist principles, alignment with Experiential Learning Theory, and resonance with Problem-Based Learning approaches solidify its relevance within educational theories. It offers a practical, experiential, and problem-centered framework, fostering inventive problem-solving skills crucial for engineering students within educational contexts.

### **Engineering Education Application**

The book intertwines engineering education by offering a transformative approach to problem-solving and innovation. Within engineering education, the integration of TRIZ principles catalyzes fostering inventive thinking and structured problem-solving methodologies among aspiring engineers.

One significant association lies in TRIZ's provision of a systematic framework that aligns seamlessly with engineering education's quest to impart structured

problem-solving skills. By introducing TRIZ concepts within engineering curricula, educators enable students to navigate intricate technical challenges systematically. This approach nurtures students' ability to dissect complex problems, identify contradictions within systems, and explore innovative solutions—a skill set crucial for engineering graduates entering diverse industrial landscapes.

Moreover, the book's emphasis on real-world applications through case studies and practical examples serves as an invaluable resource for engineering education. It bridges the gap between theoretical concepts and practical implementation, offering insights into how TRIZ methodologies can be effectively employed within manufacturing scenarios. By integrating these case studies into coursework, educators equip students with a profound understanding of TRIZ's application, preparing them for real-world problem-solving in engineering practice.

TRIZ also accentuates the importance of creative problem-solving within engineering education. By encouraging engineers (and engineering students) to explore unconventional solutions while adhering to systematic principles, TRIZ fosters a culture of creativity and innovation—a cornerstone of engineering education. This integration propels students to approach challenges with ingenuity, considering contradictions as opportunities for innovative breakthroughs—an essential mindset for tomorrow's engineers facing dynamic industry demands. Ultimately, the association between engineering education and "TRIZ - Systematic Innovation in Manufacturing" underscores the significance of TRIZ methodologies in enhancing problem-solving skills, nurturing creativity, and preparing engineering students for the intricacies of real-world manufacturing challenges (Sire et al., 2015).

### **Suitability for Engineering Students**

"TRIZ - Systematic Innovation in Manufacturing" holds significant value for engineering students aiming to enrich their problem-solving acumen within the realm of manufacturing. For students seeking to enhance their analytical and inventive skills, this book offers a structured framework in the form of TRIZ, providing a systematic approach to dissecting and resolving complex engineering challenges. It serves as a practical guide, imparting invaluable problem-solving methodologies that students can potentially apply in their academic projects and future careers.

Moreover, the book's emphasis on real-world applications tailored to the manufacturing sector renders it a pertinent resource for engineering students. Through a multitude of case studies and examples, it bridges the theoretical aspects of TRIZ with practical scenarios encountered in manufacturing environments. This integration allows students to grasp the tangible implications of TRIZ methodologies,

connecting theoretical concepts with their prospective engineering practices.

Furthermore, the book fosters an environment conducive to innovation and creativity among engineering students. By showcasing how TRIZ identifies contradictions as opportunities for inventive solutions, the book instills a mindset that encourages creative problem-solving—an indispensable skill in engineering design and innovation.

While the technical depth of certain sections might pose a challenge for students with limited prior knowledge, the book, overall, serves as a valuable companion for engineering students seeking to cultivate systematic problem-solving skills, innovative thinking, and a deeper understanding of practical applications within manufacturing contexts.

### **ARIZ Process and Manufacturing Case Study**

ARIZ stands for Algorithm for Inventive Problem Solving and is a significant methodology within the TRIZ framework, that is discussed to a great extent in Chapter 11 of this book. This algorithmic approach is designed to guide engineers and innovators in systematically addressing complex problems by providing structured steps and guidelines.

ARIZ offers a systematic process to analyze contradictions and conflicts within a system or process. It aids in identifying inventive solutions by breaking down problems into manageable parts, analyzing contradictions, and seeking innovative resolutions without compromising other elements of the system. The methodology includes multiple versions or levels (e.g., ARIZ-85C) tailored to different problem-solving scenarios.

Within the context of the book, ARIZ is likely discussed as a powerful problem-solving tool specifically applied to manufacturing scenarios. It

helps in guiding engineers through the intricate process of identifying and resolving contradictions or technical challenges within manufacturing processes, ultimately fostering innovative solutions.

### **Conclusion**

In summary, "TRIZ - Systematic Innovation in Manufacturing" book culminates as an invaluable guide, illuminating the transformative power of the Theory of Inventive Problem Solving (TRIZ) within the manufacturing landscape. With its structured approach, practical applications, and insightful strategies, the book equips professionals and engineers with a systematic toolkit to navigate complex challenges. Through inventive principles and real-world case studies, it empowers readers to optimize processes, enhance product designs, and drive innovation within manufacturing environments. As a comprehensive resource authored by experts in the field, it stands as an indispensable asset, fostering a culture of creative problem-solving and innovation within the realm of manufacturing.

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