

DESIGN THINKING: THEORY AND PRACTICE

Second Edition

Authors

Srini Tatapudi
Dr. T. G. Vasista



Iterative International Publishers

Title of the Book: Design Thinking: Theory and Practice

Second Edition - 2022

Copyright 2022 © Authors

Srini Tatapudi, IT Director (FinTech) in USA.

Dr. T. G. Vasista, Professor Pallavi Engineering College, Hyderabad, Telangana, India.

No part of this book may be reproduced or transmitted in any form by any means, electronic or mechanical, including photocopy, recording or any information storage and retrieval system, without permission in writing from the copyright owners.

Disclaimer

The authors are solely responsible for the contents published in this book. The publisher or editors don't take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the editors or publishers to avoid discrepancies in future.

E-ISBN: 978-1-68576-372-5

MRP: 200/- & 2.43\$

Publisher, Printed at & Distribution by:

INSC International Publishers

Pushpagiri Complex,

Beside SBI Housing Board,

K. M. Road Chikkamagaluru, Karnataka.

Tel.: +91-8861518868

E-mail:info@iiponline.org

IMPRINT: I I P Iterative International Publishers

About IIP

1. About Iterative International Publishers

Iterative International Publishers IIP is a leading Academic and Non-Academic Book Publishers providing publishing and marketing services under imprint IIP registered by Selfypage Developers Pvt. Ltd. Registered office is located at following address Pushpagiri Complex, Beside SBI, Housing Board, KM Road, Chikkamгалuru-577102, India and working office at mentioned location in India and also in USA at 40531, Paisley Circle, Novi, Michigan-48377 USA.

IIP is registered as publisher under Raja Ram Muhan Roy Agency, Ministry of Higher Education, Ministry of Human Resource Development, Government of India and also registered under Bowker Agency, Government of USA.

2. Our AIM

- To reach global market of publishing
- Maintaining high academic standards and production standards
- To create easy and affordable platform of self publishing
- To reach “Writer to Author Model” into everyone’s hands

3. Types of Books Published Under IIP

- **Academic Books:** Textbooks, Edited Books, Ph.D. Thesis, Conference Proceedings, Lab Manuals, and any technical books. We cover the publication of books from any field of Engineering, Medical Science, Social Science, Pharmacy, Nursing, Management, and Basic & Applied sciences (but not limited to).
- **Non Academic Books:** Poetry, Fictions, Biography, Autobiography, Novels, Stories and any non technical books.

4. Publications Till July 2022

- Number of Titles: 750+
- Number of books (printed): 25,000+ copies

- 2500+ satisfied authors
- Rs.3 Lakhs books sales per month (Approx)
- Rs. 1 Lakh monthly royalty paid out (Approx)

5. Marketing Platforms

- Our online store: www.iiponline.org and www.iipbooks.com
- Amazon
- Kindle
- Flipkart
- Facebook, LinkedIn & Instagram
- Offline through distributors

6. Unique Services of IIP

- Transparency in sales and royalty, the dedicated author dashboard to provide visibility on sales count, author profile and royalty calculations.
- Publication charges are lowest in the industry of publication which includes below mentioned key services
- Multiple iterations of content formatting and cover page design till author's satisfaction
- Listing of books in IIP online store, Amazon, Kindle and Flipkart at no additional cost.
- 30% royalty on MRP of book where author need not to bear any printing and dispatch charges.
- Unique ISBN allotment, issued by National and International Government Agencies namely Raja Ram Muhan Roy ISBN agency, Government of India and Bowker MyIdentifier, USA
- Listed at “Global Register of Publishers” <https://grp.isbn-international.org/> (use keyword “selfypage” to search)
- Sharable Authorship Certificate of Publication with ISBN number

7. Services to Authors

- 13 digit ISBN allotment to your book –Formatting is included and we are happy to provide uncapped iterations

- Formatting to Standard Book size 7 Inches width X 9 Inches Height – We can also Customise book size
- Cover page design assistance – Multiple Iterations
- Multicolour cover page printing with soft binding. Hard binding is optional at added cost
- Black and white main content printing. Colour pages printing is optional at added cost
- Online sales through IIP Online store www.iiponline.org, www.iipbooks.com, Amazon, Kindle and Flipkart.
- Ten Complimentary copies to the author. Additional copies can be provided as per author's requirement with additional charges.
- Courier and delivery charges included
- 30% royalty to the author. Printing, Logistics, Delivery included in Package

8. Supporting Services to Authors

- Membership to academicians & researchers
- Plagiarism checking using available tools
- Grammar checking using Grammarly Tool
- Quillbot tool for reframing/paraphrasing sentences
- Access to PDF conversion services using Small PDF tool
- Proof reading with nominal charges
- Content Reviewing with nominal charges
- Images & Tables design with nominal charges

9. Contact Details to Order Books

Technical Team Coordinator
 IIP Publishing House
 Contact: +91-8123969161
 visit: www.iiponline.org
www.iipbooks.com

Dedicated to



Late Dr. M. V. V. S. Murthy

(1938-2018)

Founder President of GITAM University, India

<https://www.gitam.edu/>

Preface

Design thinking plays critical role in 21st century engineering education. Engineering student buddies are expected to contribute to human society through creating innovative products and services for solving real world problems. The main objective of Design thinking course is to inculcate interdisciplinary skills among engineering students for tackling the real time engineering problems contributing to the society and industry in a collaborative manner. For this purpose it is important to focus on understanding the terminology and phrases, definitions, principles and their interrelationship with the themes and contexts of topics at hand. Design thinking is a new learning approach to address twenty first century wicked problems to be solved involving state of the art technologies that lead to use new platforms for providing innovative solutions.

Many universities are increasingly incorporating design thinking into their curricula as a result. Design thinking subject is learnt by students from various disciplines as a part of interdisciplinary but mandatory course to engineering and management education. The aim of the design thinking course is to make engineering student buddies to progressively acquire skills of synthesis towards professionally appraising the value by evaluating the products and services. For this purpose, design thinking subject is required to be learnt from fundamental and conceptual levels towards acquiring practical skills by applying meta-cognitive knowledge of analysis and synthesis procedures for achieving the problem solving capabilities across project level, business level and system level in general.

Design thinking follows the human-centred design approach by promoting trans-disciplinary creative thinking and collaboration, enabling students with acquiring cross-disciplinary skills to bridge the gap between theoretical knowledge and professional practice.

Many text books are available to refer and read the subject of design thinking for its learning.

The benefit of reading this book by both faculty and students is well managing their teaching and learning process of design thinking subject in

the form of one stop read of the subject. This book is prepared to match the topics mentioned specific to the university syllabus in a semester based busy schedule, especially to read it while faculty and students focusing on others subjects of their professional core learning in parallel relevant to their specific branch. Also this book is attempted to focus on keeping all those topics by offering a progressively learning approach of the topic with increasing complexity considering both by making theoretical and practical learning attempts. Students are suitably guided to bring the outcomes of learning i.e. preparing both ‘design thinking’ process documents as well as power point presentation slides based prototypes taking examples of applying Software and IoT application techniques to their engineering and business problems from various fields.

We strongly believe that this becomes a mandatory reading book for students pursuing engineering and management education.

Srini Tatapudi

T. G. Vasista

Acknowledgements

Authors take this opportunity to acknowledge the following professionals who agreed to provide their efforts and offering their invaluable suggestions and in making book review comments. In this regard authors are extending their sincere thanks to them as well as to various authors from research community who are directly and indirectly contributed in developing this book as a one stop read guide to Design Thinking:



Dr. Bhuvanesh Unhelkar (BE, MDBA, MSc, PhD; FACS; PSM-I; CBAP®) has extensive strategic and hands-on professional experience in the Information and Communication Technologies (ICT) industry. He is a Professor of IT lead faculty at the USFSM-University of South Florida Sarasota-Manatee and is the founder and Consultant at Method Science. Prof. Bhuvan is a thought-leader and a prolific author of 20 Books – including Big Data Strategies for Agile Business and The Art of Agile Practice (Taylor and Francis/CRC Press, USA) and other. He is a winner of the Computerworld Object Developer Award (1995).



Dr. Luay M. Assidmi is currently working as an Assistant Professor of Information Systems department of College of Computer Engineering & Sciences at Prince Sattam bin Abdulaziz University, KSA Enterprise Architect, Digital Transformation Consultant, Deputy of Development and Business Intelligence Architect of the same university. He published computer related articles in Springer and IEEE Journals and also in international conferences.



Dr. Ahmad Zamil is currently an Associate Professor in Marketing and Executive Director Strategic Plan and Studies Management at Prince Sattam bin Abdulaziz University, KSA. He obtained a Master of Commerce and a Ph. D in Marketing from University of Pune, India. He has about 26 yrs of experience in teaching and research in Jordan and Saudi Arabia. His interested areas include Marketing management. Marketing Strategy, Banking Marketing, Health Marketing, Consumer Behavior,

International Marketing, CRM, Service Marketing, Sales Management, Feasibility studies and Risk Management. He published more than (80) papers in international referred journals and Conferences, and (7) Books related to marketing in Arabic and serving on the editorial board of several international journals.

Srini Tatapudi

T. G. Vasista

Foreword

This book in your hand provides an important tool in your Design Thinking (DT) journey. DT is integrated in the life of every engineer - starting right from designing a paper plane through to designing a space craft. With rapid advances in robotics and automation, almost all modern-day gadgets require critical approach to their concepts, carefully analysis of their applicability and continuous testing in order to succeed with their designs. Design Thinking is essential for innovation, creatively designing a produce and eventually commercializing it. For this purpose, design thinking subject spans conceptual thinking through to competencies in practical application. Problem-solving is integral to good designs at various levels in the industry. Needless to say, all engineering curriculums invariably include DT.

I believe this book will serve students for many years as they learn the basics of DT and then extend it in practice. Students will find this book most helpful in developing their interdisciplinary skills that not only creates efficient designs from an engineering perspective but also provides value to the society at large. In addition to generating innovative designs, this book will also help you understand skills in ascertaining product values through evaluations. Design thinking is an interdisciplinary skill-set combining creative thinking and collaboration in order to bring the designs to fruition. Eventually, these skills you acquire will lead to excellence in design thinking for product innovation. This book presents those imperative skills by starting with the important yet succinct introduction to the subject, then moving towards ideas generation, followed by creating comprehensive designs and eventually applying it to various disciplines. The learning outcomes for a university level DT course are carefully reflected in modules and the overall organization of the book. Furthermore, the important intersection between DT and Agility (notably Scrum and Kanban) makes this a worthwhile book for any contemporary engineering student. This is so because Agility can help reduce the risks in design, keep the focus on the users and optimize overall value creation.

The progressively learning approach to DT in this book will aid faculty members in their effort to teach this course in a systematic manner that judiciously combines theory with practice. The course aids accompanying this book including documentation and presentation will

free up time for busy faculty members – enabling them to concentrate on imparting the skills through explanations, question & answers and practical work.

This book is written by authors who are accomplished professionals in their respective disciplines. The authors bring together the best of both consulting and academic worlds in this book with the aim of benefitting the readers. While Srinivas has been a consummate professional working in the industry over many decades, Gopi is teaching this course in an academic setting over similar period. These authors have combined their specific competencies in producing this book for you - primarily the students of DT.



Bhuvan Unhelkar
Professor
University of South Florida
USA

Endorsement

Problem solving is a key skill for success within our rapidly changing society. Design thinking is part of our problem solving and is a must have skill for future success in our rapidly changing technological society. Being able to work end-to-end across areas of expertise comes from the practical pragmatic application of design thinking. Whether we want a career in technology or business, in public service, or in education and healthcare, a book like this can help us all with maturing our critical thinking and in enhancing our problem solving skills. This book may be of good help to you in the journey of acquiring pragmatic design thinking skills ---



Keith Sherringham, BSc (Hons), FACS, consults to executive and senior leadership in corporations and government on business strategy and planning, the business application of ICT, and business services and operational improvement, as well as delivering high - profile business transformations. Keith is a noted author and speaker on the business application of ICT and is known for his thought leadership and pragmatic strategy in areas including real-time decision making, business transformation, and standardizing the roles of knowledge workers. He peer-reviews papers and proposals for leading journals and publishing houses. He is a board director for the Australian Computer Society and has guest lectured at various universities in Australia and overseas on the impacts of changes in ICT to business. Keith is a company director, director for not-for-profits, and mentor to CEOs and boards within not-for-profits.

Design Thinking Course Coverage

Content Objectives

- To familiarize engineering design and product design process
- To introduce the basics of design thinking
- To bring awareness on idea generation
- To familiarize the role of design thinking in services and e-services design

Content Outcomes: At the end of this course, the reader gets familiar with

- Innovating with new methods in product development
- Applying Design Thinking in developing the new designs
- Selecting ideas from ideation methods in new product development
- Using Design Thinking in developing software products
- Applying principles of Design Thinking in service design

Text Book(s)

1. Pahl, Beitz, Feldhusen, Grote – Engineering Design: a systematic approach, Springer, 2007
2. Christoph Meinel and Larry Leifer, Design Thinking, Springer, 2011
3. Aders Riise Maehlum - Extending the TILES Toolkit – from Ideation to Prototyping
4. <http://www.algarytm.comA/it-executives-guide-to-design-thinking>: e-book.
5. Marc stick-on and Jacob Schneider, This is Service Design Thinking, Wiley, 2011

Table of Contents

| Description | Page No. |
|---|--------------|
| Dedication | vi |
| Preface | vii |
| Acknowledgements | ix |
| Foreword | xi |
| Endorsement | xiii |
| Course Coverage | xiv |
| Chapter-1: Introduction to Design | 3-12 |
| 1.1 Introduction to Design, Development and Innovation | 3 |
| 1.1.1 Introduction to Product design and development | 6 |
| 1.1.2 Definitions of Product design, Product development and Product innovation | 7 |
| 1.1.3 Characteristics of successful product development | 7 |
| 1.1.4 Product Lifecycle Management (PLM) | 7 |
| 1.1.5 Product Life Cycle Phases | 8 |
| 1.1.6 Product Design and Development Process | 8 |
| 1.2 New product development opportunities | 9 |
| 1.3 New product development plan | 10 |
| 1.3.1 Outlining the Product Feasibility Analysis | 10 |
| 1.3.2 The basic components of Product Plan | 10 |
| 1.3.3 Outlining the Product Planning Process | 10 |
| 1.4 Conclusion | 11 |
| Questions | 12 |
| Practices | 12 |
| Chapter-2: Design Thinking | 13-26 |
| 2.1 Introduction to Design Thinking | 15 |
| 2.2 Principles of Design Thinking | 15 |
| 2.2.1 Definitions and the Conceptual Approaches of Design Thinking | 15 |
| 2.3 Benefits of Design Thinking | 18 |
| 2.4 Design Thinking Process and Innovation | 18 |
| 2.4.1 The design thinking process of Hasso-Plattner Institute in Design at Stanford University, | 19 |

| | |
|--|--------------|
| USA | |
| 2.4.2 Innovation and its Definition | 20 |
| 2.4.3 Types of Innovation | 22 |
| 2.5 Case Study: Implementing innovation in Commercial Building Conceptual Framework | 23 |
| 2.6 Conclusion | 25 |
| Questions | 25 |
| Practices | 25 |
| Chapter-3: Idea Generation | 27-40 |
| 3.1 Introduction to Idea Generation | 29 |
| 3.2 Idea Generation Techniques | 30 |
| 3.2.1 Other methods | 32 |
| 3.2.2 Categorization of idea generation techniques based on the idea generation model | 35 |
| 3.3 Selecting idea from Ideation methods | 35 |
| 3.4 Case Study and Identification of the selection of right ideation method to the case case Title: AI-Based Models in Commercial Buildings | 37 |
| 3.5 Design thinking tools | 38 |
| 3.6 TILES Idea generator | 38 |
| 3.7 Conclusion | 39 |
| Questions | 40 |
| Practice | 40 |
| Chapter-4: Design Thinking in IT & Business Fields | 41-54 |
| 4.1 Design Thinking in Information Technology | 43 |
| 4.2 Use Design Thinking in Business Process Model | 43 |
| 4.3 Apply Design Thinking for Agile Software Development | 45 |
| 4.3.1 Agile Software Development | 45 |
| 4.3.2 Similarities and Differences between Design Thinking and SCRUM | 46 |
| 4.3.3 Virtual Collaboration | 47 |
| 4.3.4 Multi User and Multi Account Interaction | 47 |
| 4.4 Use TILES toolkit | 48 |
| 4.5 Cloud Implementation of design thinking | 50 |
| 4.6 Conclusion | 52 |
| Questions | 52 |
| Practices | 52 |

| | |
|---|--------------|
| Chapter-5: Design Thinking for Service Design | 53-72 |
| 5.1 Introduction to design thinking in service design | 55 |
| 5.1.1 Service design Theory towards Intelligent semantic electronic service design | 56 |
| 5.2 Service Design Principles | 58 |
| 5.2.1 Describing the five principles of interactive service design | 58 |
| 5.2.2 List of Digital Service Design Principles | 59 |
| 5.3 Benefits of service design thinking | 60 |
| 5.4 Role of Designer in Service Design Thinking | 60 |
| 5.5 Assumptions of Service Design | 61 |
| 5.6 Service and Service design blueprint | 61 |
| 5.6.1 Briefly description of the components of service blue print (keeping IoT technology examples in mind) | 62 |
| 5.7 Applying the information technology based plug-in architecture principles to service design | 68 |
| 5.8 Conclusion | 69 |
| Questions | 70 |
| Practice | 70 |
| Bibliography | 71-80 |
| Index Terms | 81-88 |

DESIGN THINKING: THEORY AND PRACTICE

Design is a virtual realization of a concept or idea into a configuration, drawing or a product. Design Thinking is cognitive and practical processes by which design concepts are developed by designers. Innovation is a new idea or a new concept transforming to obtain commercial value from a delivered product or a service.

This book is targeted to serve as a one stop study guide to be used primarily but not limited to...by the university faculty and students who are involved in teaching and learning the theory, concepts and practical approaches to an interdisciplinary Design Thinking subject. It leads the reader from its traditional understanding of the subject towards innovative understanding and the application of design thinking innovatively to involve AI, IoT and Semantic Web Services based technologies.

About the Authors



Mr. SRINI TATAPUDI is an IT Director (FinTech) in USA. He has over 20 years of technology global experience in the field of Information Systems of Information Technology industry across countries (India, Australia, Malaysia and USA). He is known for strategic thinking and planning into future with innovation mind. He leads digital design teams delivering technology products to market by promoting Design Thinking. He is certified in PMP, ITIL, CSM, CSPO, PSM-I, SCAM, SCAC and managed significant number of IT project portfolios in USA.



DR. T. G. VASISTA is a Director cum Education and Research consultant at Vasista Consulting and Performing Services Pvt. Ltd, India. He has over 25 years overall experience in addition to the educational qualifications period, covering IT industry experience in India & USA. He has exclusive researcher experience in Saudi Arabia in the field of eBiz, eCom & eGov. His teaching experience includes Software, IT, Management Information systems and Construction management fields served in India, Libya, Saudi Arabia and Ethiopia. He has about 80 publications consisting of books, book chapters, research papers and articles in various national, international conferences and journals with publishing organizations like ACPI, AIRCC, IBIMA, IEEE, IGI Global, MacMillan, Springer, etc. publishers and indexed with leading research data bases like EBSCO, Proquest, Scopus, Publon and Google Scholar. He won best paper award in IT National Conference at APIM, 2007, New Delhi. He received excellent construct reviewer award three times from IBIMA International conferences, 2018 Best Researcher Award from IOSRD in Visakhapatnam and 2022 Best Teacher Award from IMRF, Vijayawada, India.



E-ISBN: 978-1-68576-372-5



MRP: 200/- & 2.43\$