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ENGINEERING ENTREPRENEURSHIP FROM IDEA TO BUSINESS PLAN

ENGINEERING ENTREPRENEURSHIP FROM IDEA TO BUSINESS PLAN

A Guide for
Innovative Engineers
and Scientists



PAUL SWAMIDASS

CAMBRIDGE

BOOK TITLE

ENGINEERING ENTREPRENEURSHIP FROM IDEA TO BUSINESS PLAN

***A GUIDE FOR INNOVATIVE ENGINEERS AND
SCIENTISTS***

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Author:
Paul Swamidass, Ph. D.
Professor Emeritus, Harbert College of Business
Auburn University, Auburn, AL, USA

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**The author used the contents of the book for 15 years in Auburn-
University courses**

Included in the following pages

Table of Contents

&

Chapter 1: Engineers Create Value for Investors

TABLE OF CONTENTS

A 10-WEEK BLUEPRINT FOR VALUE CREATION

The book is deliberately designed with short, concise chapters that are to the point. Therefore the book is able to include many short chapters to cover a wide range of topics important to a technological innovator.

The chapters are arranged in a 10-week blueprint for action or a blueprint for a college course.

To see the listing of chapters go to the next page

Contents

Preface

Acknowledgments

page xi
xiii

WEEK 1

CREATE VALUE IN THREE PHASES

1

Engineers Create Value for Investors.....

3

Case Study 1: A Value Creator on the *Shark Tank* Show

5

Case Study 2: GoldieBlox – a Massive Value Creator

7

TECHNOLOGICAL INNOVATION AND INNOVATORS

2

Introduction to Technological Innovation

13

3

The Seven Phases of Technological Innovation

16

4

Engineers Add Value in Stages

21

5

Disruptive Technological Innovators: Value Creators

23

WEEK 2

PHASE 1: CREATE VALUE THROUGH A NEW IDEA:

FINDING YOUR IDEA

6

Ideas: How Do You Find Them?.....

29

WEEK 3–4

PHASE 2: CREATE A PRODUCT

7

Turn Your Idea into a Product

39

8

Early Detection of Market Potential

47

by A. David Mixson

9 **Illustrative Case: Tennis Racquet Customer-Needs Survey**52

10 **What Engineers Can Do for Product Development**55

WEEK 5

PATENTING AND PROTECTING YOUR INTELLECTUAL PROPERTY

11 **Intellectual Property, Patents, and Trade Secret**.....61

12 **If You Cannot Afford a Patent Attorney**.....67

 Supplement 1: USPTO Establishes Special Examination
 Unit for Pro Se Applicants.70

 Supplement 2: Low-Cost Provisional Patent Applications70

 Supplement 3: Low-Cost Nonprovisional Patents72

 Supplement 4: USPTO Examiners Help Nonprovisional
 Pro Se Applicants74

13 **Reading and Learning from a Granted US Patent**.....76

 Supplement 1: US Patent: 7479949 “Touch Screen
 Device...” Steve Jobs and Others (Excerpts Only).....78

 Supplement 2: ReadeREST: An Example of a Successful Patent.....80

14 **Patent Search and Conclusions before Drafting a Patent Application** ...87

15 **Pro Se US Patent Applications Do Succeed**89

WEEK 6

THE BUSINESS MODEL AND BUSINESS PLAN: *CUSTOMERS,*
TARGET MARKETS, COMPETITORS, AND MARKETING

16 **Macroeconomics for Innovators in Engineering and Science**95

17 **Customers, Target Markets, and Marketing**.....99

18 **The Power of Social Media Marketing** 101

by Haitham A. Eletrabi

19 **Market Analysis Resources**105

20 **Illustrative Case: Market Analysis for Tennis Racquets**108

21 **Competition Research**111

WEEK 7

MANUFACTURING, SOURCING, DISTRIBUTION, AND
REACHING THE CUSTOMER

22 **Manufacturing and Sourcing**115

23 **Break-Even Analysis**119

24 **Sales and Distribution – Wholesale, Direct, and Other**122

25 **Reaching Your Customer: Advertising and Promotion**125

WEEK 8
SELECT YOUR BUSINESS MODEL

26 **Selecting the Pre-Start-Up Business Model**.....129

WEEK 9
ESTIMATED COSTS, PRICE, AND PROFITS

27 **Key Decisions: Costs Estimation and Pricing**139

WEEK 10
ASSEMBLE A BUSINESS PLAN TO ATTRACT INVESTORS

28 **The Business Model versus the Business Plan**149

29 **The Business Plan: The End of Phase 3.**153

30 **A Business Plan Is a War Plan: Anything Can Change**155

31 **Making the Start-Up Business Financially Feasible**157

32 **What Angel Investors Look for in a Phase 4 Company Seeking Funding**160

33 **Ethics in Engineering and Business Professions**.....163
 Supplement 1: ABET Code of Ethics for Engineers165
 Supplement 2: Corporate Code of Ethics: AT&T Inc.....166
 Supplement 3: Corporate Code of Conduct: Google167

34 **Business as a Legal Entity in the United States**169

35 **Pre-Start-Up Business Organization and Management**172

36 **An Illustrative Case: Amazon.com as a Start-Up**.....174

BEYOND WEEK 10
EXECUTION PHASES 4–7: THE VIEW BEYOND THE BUSINESS PLAN:
CREATING AND OPERATING THE BUSINESS

37 **Execution Phases 4 to 6**179

38 **Phase 7: Six Case Studies of Mature Firms**182

39 **Comparing Phase 7 Firms from Different Industries: Apple and Walmart.**.....191

PREPARING TO BE AN ENTREPRENEUR

40 **Teams and Teamwork**195

41 **Leadership Issues in Start-Up Businesses**198
by Jay Clark

42 **What We Know about Entrepreneurs** 201

43 **Creating Value as an Engineer in India**203
by Hephzibah Stephen

44 **Technology Licensing Option for Inventors**206

Appendixes

A The Language of Engineers209

B Illustrative Document: Non-Disclosure Agreement214

C US Patent Office Documents217

 C.1 USPTO: Steps for Patent Application.219

 C.2 USPTO: Provisional Patent Application.222

 C.3 USPTO Forms225

References and Selected Bibliography 231

Index 235

1 Engineers Create Value for Investors

When you ask an engineer what engineers do, the common response is that engineers solve and fix problems, design and model things and systems, create mathematical models, and many other variations along the same lines.



Figure 1.1. The million-dollar journey of an engineer’s idea

Actually, engineers create value for investors as shown in Figure 1.1. To explain the table and bar graph in Figure 1.1, imagine that engineers produce 100 ideas: 50 of them may be reduced to individual products; 15 may be patentable or patented; 7 may support a WORKABLE business model; 5 may lead to solid business models and business plans with ADEQUATE five-year CASH FLOW into the future; 2 may have the RIGHT PEOPLE to manage the start-up (including the engineer-entrepreneur, most often); and finally 2 may have real or potential sales that could interest wealthy investors to value the business at a million dollars (Swamidass, 2014).

In this hypothetical journey, 100 ideas may produce two start-ups valued at a million dollars each by wealthy investors, who may invest in them as a result of their valuation. By creating value for investors, engineers could become entrepreneurs using their own ideas, while using investment capital from wealthy investors – a win-win situation for both the engineer and the investor; some engineers/scientists, not interested in starting and running a business, may license the technology to investors/licensees, and may let them start and run the business in return for royalties and/or equity.

While engineers who work for an employer may think they are merely solving problems for their employers, they are actually creating value for their employers too; their employer benefits, and so do their customers.

Why This Book? What Is the Book's Theme?

Having taught hundreds of students from business and engineering colleges at Auburn University for 15 years using the contents of this book, it allowed the author to refine it into a volume that will adequately prepare engineers and engineering students to acquire the confidence necessary to recognize a commercially viable idea and graduate it to a tangible product, which in turn will lead to profit-making new businesses. Engineering students, with their college training, can create numerous products of value for investors and society at large.

Of course, not all engineers/scientists who invent must start their own businesses. There are plenty of investors who are eager to license promising products developed by engineers. Licensees with business and investment skills could start and run a new business, or add the licensed product under the umbrella of an already existing business that pays regular royalty to the inventor.

Each year, millions of engineers graduate from engineering colleges worldwide, and there are at least four times as many students in university engineering colleges as the number that graduate each year. Their creative potential is often lost to society because they lack the training and encouragement in their education necessary to develop ideas into inventions of not merely new products, but products that can create value for wealthy investors.



Figure 1.2. Basic Principles of Business for Engineers.

Engineering students and engineers often scale back or even completely abandon their creative efforts because they mistakenly believe that they must have the investment capital to make their inventions become commercially successful. That is not true. If they have a strong idea, a commercially viable product, and patent protection, experienced investors can join them or take over the business part of delivering the invention to consumers. *This is the theme of this book.*

1. Engineers Create Value for Investors

5



Figure 1.3. Thousands of customers in a long line outside the Apple store, New York City, September 2014, the day of the launch of iPhone 6.

(Photo © Cicchetti /Shutterstock.com, 218258131)

Engineers must pay close attention to the fundamental principles of business, presented in Figure 1.2. A product based on their idea must satisfy consumer needs, and thus attract customers (Figure 1.3), in order to create, in turn, a viable, profitable business. Without a product there can be no business. Therefore, engineers will be rewarded if they devote their time to creating products from their ideas that appeal to customers; if they do so, investors and their capital will follow.

Case Study 1

A Value Creator on the *Shark Tank* Show

Engineers unfamiliar with the idea of value creation for investors must watch the American TV series *Shark Tank*, which provides several good examples each week; archived shows can be viewed online at ABC and CNBC websites, YouTube, and other Web-based locations.

On *Shark Tank*, inventors receive investment to expand and grow their businesses, as well as support and advice from billionaire “sharks” in exchange for equity in the company started by the inventor. In return for a share of ownership in the start-up business given away to the “shark,” the inventor receives access to their capital, expertise, network of manufacturers, retail outlets, access to US and international markets, and expert advice for rapid growth – all of them invaluable.

One of the best learning moments on the show occurred when Rick Hopper appeared on the show asking for \$150,000 in return for 15 percent equity in his company for his very simple invention, ReadeREST, a device that secures eyeglasses or sunglasses to a shirt, coat, or other garment. The following figure shows his product, now sold on the Web as well as in several brick-and-mortar outlets. The video of the successful presentation on the *Shark Tank* show can be accessed on YouTube, ABC TV archives, CNBC archives or other archives for online videos.

In the archived YouTube presentation there are many valuable lessons for a professionally trained engineer as well as for anyone with even rudimentary engineering



Figure 1.4. ReaderREST (Amazon.com; January 2016).

skills. Whether Rick Hopper is an engineer with a college degree or not, his presentation shows that he has the skills to devise a solution using engineering principles. With that rudimentary product, he created value for wealthy investors such as Lori Greiner, one of the “sharks” in the *Shark Tank*, who invested \$150,000 in Hopper’s invention in return for 65 percent of his company; two years after that particular segment aired, sales of ReaderREST reached nearly \$10 million, creating value for inventor Rick Hopper and investor Lori Greiner.

The facts of Rick Hopper’s case:

1. A simple unsolved problem exists, namely, there is no good place to store glasses on one’s person without using a case (bulky, uncomfortable) or unsightly devices such as “granny chains.”
2. Hopper develops a simple solution using magnets and paperclips.
3. A patent search reveals to him that he is the second inventor with this idea; the full patent from the first inventor is reproduced in Chapter 13, Supplement 2.
4. There is no product in the market based on the original patent.
5. Hopper makes a great decision; using the published patent document he identifies the original inventor, contacts him, negotiates, and purchases the patent for \$5,000.
6. Before Hopper appeared on the *Shark Tank* show, sales of ReaderREST had reached about \$65,000, and he wanted to partner up with one or more investors from the show to grow and expand, nationally and internationally; he manufactures the items in his garage for about \$1.05 each.
7. He sells them in a \$9.99–19.99 price range on Amazon.com (Figure 1.4) and other Web-based retail outfits.

1. Engineers Create Value for Investors

7

8. He asks for a \$150,000 investment from the “sharks” for a 15 percent equity ownership stake in his company, ReaderREST, implying a company valuation at \$1 million.
9. Lori Greiner, one of the “sharks” on the show, offers \$150,000 for 65 percent of the company (valuation has been reduced by Lori Greiner to \$231,000), with a promise to make him a millionaire soon.
10. Hopper has invested \$5,000 to buy an issued patent and received \$150,000 by giving up majority ownership in his own company and allowing Lori Greiner to control his company, but with a promise of much more income to come in the future.
11. He accepted the offer in 2012; by December 2014, sales of ReadeREST reached nearly \$10 million; clearly Lori Greiner’s capital and active participation have helped the company and its value grow.
12. Hopper has created value for Lori Greiner and himself through a simple invention that weighs less than two quarters (Figure 1.5).



Figure 1.5. ReadeREST next to two US quarters.

This case shows that commercial success is possible and within reach even with a simple idea and product. There is a lesson here for future engineer-entrepreneurs who may tend to make things too complicated for themselves: **You can build value with simple ideas and products, and you may let the investor turn your product into a large, viable, income-producing business.**

Case Study 2

GoldieBlox – a Massive Value Creator

Debbie Sterling, while a student at Stanford University, realized there were very few female students at engineering colleges or in engineering programs at universities (less than 11 percent when she was in college). She developed a passion for the idea of introducing girls to the joy of engineering at an early age. She could have chosen to do any number of things/products to put her idea into practice; she chose to create toys that are attractive to girls but with engineering content that is lacking in current toys for girls. Go to YouTube to watch her in a Kickstarter (Kickstarter is a crowd funding website that inventors use to seek funding from the public, without giving away ownership in the business/product) video promoting her new GoldieBlox line of toys aimed at preparing girls for a potential career in



Figure 1.6. Examples of two boxed GoldieBlox toys.

(Photo © author)

engineering: www.youtube.com/watch?v=y-AtZfNU3zw (Note: the website may become obsolete with time)

From the video and Kickstarter website we note the following:

1. In converting the idea to a product, Sterling reasoned: “Girls like to read; boys like to build.”
2. She designed an engineering-themed toy that helps a “girl inventor” build simple machines using a combination of spatial and verbal skills.
3. The toy was accompanied by a “girls-friendly” book and a tool kit.
4. The colors chosen for the toy were girls-friendly.
5. Sterling claimed she invested all her assets to make one working, high-quality prototype.
6. She tested it personally with more than 100 children and parents.
7. Sterling made an expensive video to promote her GoldieBlox toy on Kickstarter, seeking funds to place a manufacturing order for at least 5,000 units; she launched the project on September 18, 2012, seeking \$150,000.
8. Four days later, on September 24, Sterling reached her funding goal; the toy went into production right away.
9. By October 18 – merely a month after launching her Kickstarter campaign – she had collected almost \$285,000 from 5,519 backers, with an average contribution of \$51.60.

Debbie Sterling’s value creation with this product goes beyond purely monetary; she has enabled thousands of young girls to awaken their interest – and potentially their skills – in engineering via an experience acquired playing with a new line of toys. The societal value of her achievement is truly priceless. The author saw the Kickstarter video in 2013 and immediately ordered the original GoldieBlox toy for his granddaughter, who was seven years old at the time.

1. *Engineers Create Value for Investors*

9

Of course, given the toy's target audience, we will have to wait about ten to fifteen years to find out if the young girls exposed to GoldieBlox are any more interested in engineering careers than girls not exposed to it. Regardless of the future results, however, Sterling has succeeded in starting with a difficult idea, turning it into a viable product, and eventually achieving great commercial success; the GoldieBlox line now sells widely both online and in brick-and-mortar retail outlets (Figure 1.6). Her products have been so successful that in 2014, Sterling's company could afford to run a 30-seconds advertising spot during Super Bowl – the most widely watched program in the United States practically every year, and thus carrying the highest price tag for ad time of any TV show (Said, 2014).

Compared to Hopper's idea presented earlier in the chapter, Sterling's idea to introduce girls to the joy of engineering at an early age is a complex and difficult idea to reduce to a product. But she was not swayed by decades of unsuccessful attempts of federal and state governments to attract female students to engineering programs; she chose to take on the challenge, and in the process created value for herself and her investors, as well as, of course, for girls and their parents. The growth rate and the sheer magnitude of her commercial success are very large because she took on a very difficult idea to commercialize. There is a lesson here for aspiring innovators: when a difficult idea is commercialized successfully, it brings great returns to the inventor; an extreme example would be an invention for generating inexpensive energy from sea waves. A commercially successful inexpensive wave-energy converter will be financially very rewarding to the inventor; while there are many inventions today for converting waves to energy, none hugely successful as of yet.

For quick success, take on a simpler product for commercialization to build up your financial capital to take on larger challenges later. Inventor-entrepreneur Elon Musk, founder of Tesla Motors and SpaceX, has projects that could be described as “going to the moon,” literally, but he is backed by \$14 billion personal wealth (as of 2016) that he has accumulated as a cofounder of PayPal.