

Accelerating New Food Product Design and Development

EDITORS

Jacqueline H. Beckley • M. Michele Foley

Elizabeth J. Topp • J. C. Huang

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DEDICATION

To current and future product developers who seek knowledge from those who learn their lessons by doing the work they talk about. To the Product Development and Marketing Management Divisions of IFT for their support of our programs for the members of the Institute of Food Technologists.

Titles in the *IFT Press* series

- *Accelerating New Food Product Design and Development* (Jacqueline H. Beckley, Elizabeth J. Topp, M. Michele Foley, J. C. Huang, and Witoon Prinyawiwatkul)
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PREFACE

Innovation today goes beyond new products. To be successful, organizations need to innovate to reinvent every area of the business—systems, processes, technologies, strategies, and business models. This book addresses innovation in developing new products with a focus on challenging the status quo, changing how we think about our work, and adapting to meet the business needs. The authors provide unique perspectives based on their personal experiences to the challenging world of new product development. If you want to innovate faster, it's worth taking the time to read through these chapters—you're sure to find a valuable nugget that will change the way you think about your work. Today and tomorrow.

How to read this book:

Part I is titled understanding product development in Today's Food Industry. The content in this chapter has strategic implications from a historical, organizational, relational, and philosophical perspective.

Part II is titled Accelerating Food Product Design and Development. The content relates to many aspects of implementation of current thinking in food product design from brand, market, process, people, package, and management orientation.

Part III, titled Optimizing Food Product Design and Development, provides the reader with more tactical approaches to product design and development. The tactics are made tangible through very specific examples of high level quantification methods used regularly in the implementation phase of product development.

Each part had an editor of its own (Part I – Topp, Part II – Foley, Part III – Huang and Prinyawiwatkul) who has brought forward the authors' voices. Please enjoy our book.

Accelerating New Food Product Design and Development

Chapter 1

INTRODUCTION

*Jacqueline H. Eckley, M. Michele Foley, Elizabeth J. Topp,
J. C. Huang, and Witoon Prinyawiwatkul*

“It is hard to fail, but it is worse never to have tried to succeed.”

—Theodore Roosevelt, 26th president of the United States

This book is about change. It is based on three extremely popular symposia conducted at the Institute of Food Technologists’ annual meetings in the summers of 2004 and 2005. The symposia were developed for the Product Development and Marketing and Management Divisions and were designed to provide some clarity about the past life of food scientists and what tools and thinking these individuals might provide for the future. Parts 1 and 2 are geared toward management and strategy of business people and scientists. Part 3 provides more “hands-on” orientation to quantitative methods that the previous two parts assume is in place. This book fits well within a series of books that Blackwell has published over the last several years. The book has been designed with food industry professionals in mind. In editing the presentations, the authors were thinking of the following individuals as potential readers:

- Director, vice president, or chief technology officer of a product-development group
- Bench scientist who works to make the product successful
- Professor who teaches students to be successful business leaders
- Quality assurance technicians who are responsible for the certification of safe products in a manufacturing facility
- Marketing manager
- Research insights manager

- Project technician
- Food industry consultant
- Sensory scientist
- And many more

Why this very broad definition of an executive? Today, big and small companies struggle to maintain relevance with the consumer. Their work is sometimes unacknowledged and unappreciated; yet it all is part of this industry. The food industry has a long classic tradition, yet needs to move into the experience-based world of today.

This book seeks to begin to address some of the comments made to the editors during its preparation:

“Most companies are more interested in spending money safely without results, than finding the results to save them yet needing to spend money in unconventional ways.” (Read chapter 5.)

“Following the process is more important than finding the solutions.” (Read chapter 2.)

“What bothers me as an action oriented young professional? People in middle to upper management who are unable to make decisions. They fear making the wrong decision or taking a chance, so instead they make no decision at all. This makes the speed at which business takes place very slow, which around here usually results in our missing big opportunities in the marketplace.” (Read chapter 7.)

“When companies are in trouble, their decision making goes from smart to stupid, from rational to irrational.” (Read chapter 11.)

“I strongly believe that in a system of 25 employees, all working on the same project (launch for example) that only 8 of these people are connected well enough to make things happen. The rest of the 25 are the ones who are constantly looking for help on how to do things, or whom to see to get certain job specific duties completed. They always end up at the desk of one of these 8 connected people, who then have to direct them as to whom to see in order to get this done; which more times than not is one of the other 8 doers. ’ So wasteful”
Comments by a young packaging engineer at a highly successful and profitable consumer package goods company. (Read chapter 12.)

At the time of the symposia, given during two IFT technical meetings, many of the writers of these chapters were speakers. They were very

specially selected for their range of expertise in the field and for their capability to speak authoritatively on their subjects. It is very rare to get this type of person to write a book chapter. They just won't take the time. But they did for this book. And for you. So we hope you enjoy the unique perspective that each of these writers takes on his or her storytelling journey, which provides you with insight into:

Accelerating new food product development:

To compete in today's marketplace, food product development is under pressure to create innovative new products at a time when there are pressures to cut back on development costs, labor, and other problem-solving tools. RD groups are in a constant mode of development and improvement over the last successes they achieved. Additionally, companies must balance the needs of consumers, customers, the company and its position in the world, timetables, and resources. Consumers today want choices, but they hate too many choices. They want intelligent marketing but it has to be shorter than a 15-second TV spot. They want uniqueness, but not too different. They want luxury and upscale qualities, but prefer to buy value. Companies need profitability and news, but they need to have it without cost. Research departments have put in new product development processes and encourage their staffs to innovate, yet have reduced the number of suppliers and require that those suppliers provide discounts. Universities have well-trained professors who are under budget constraints. The university programs are good yet lack much grounding in today's business and product development environment. We know that packaging can drive innovation, but we cannot afford the time it takes to get that new film or the mold. What are product developers to do? The trade-offs they face today are tremendous. Chapter authors present perspectives of why we are accelerating and why the speed seems so exhausting, in addition to some approaches that have worked in their business lives with specific food product development examples.

Optimizing new food product development:

Food scientists are often faced with developing new products such as functional foods marketed toward health-conscious people to meet growing consumer trends. The parameters of the product being developed need to be analyzed in each stage by either instrumental or sensory data to ensure that development goals are met. Statistical tools are often improperly utilized when trying to determine factors

that contribute to product quality, consumer acceptance, and purchase decisions. Also, an inappropriate experimental design or data analysis will not help the developer identify and simplify parameters in formulation consideration. The process of developing new products is often time consuming and costly when all factors are taken into consideration. First, scientists have to identify the important factors and responses to minimize the number of factors (ingredients, temperature, etc.) and responses (instrumental and sensory data) for pilot plant tests; then they have to continuously minimize and optimize for the production test. Appropriate experimental designs in food product development start in the early stages and often can reduce unnecessary tasks at later stages. Factors that may influence product quality can be funneled to a few that have significant effects as well as interaction effects that can be detected by the experimental design. Thus, an effort to facilitate the new product-development process, various experimental designs, and data-analysis methods can be used in each step to shorten the timeline and optimize the formulation more efficiently. This book lays out a clear picture of new product-development process along with appropriate design and analysis methods. Authors use a conceptual/intuitive approach to convey experimental design and data analysis to the reader. Authors also demonstrate a series of data-analysis techniques performed to identify sensory attributes critical to consumers' purchase decisions and to attain an optimal product-formulation range. This will enable food scientists not only to make sound scientific conclusions but also to succeed in new product development or new technology because the conclusions and results are made based on parameters representing the true population.

The presentations that these chapters represent are *conversations* that industry professionals who are engaged everyday in work for the food industry would have with you, if they had the time. We have stripped away the clutter that often bogs us down at work (bureaucracy, processes that cost a lot to be implemented and still don't work, and politics of business) to present a summary of thinking at the beginning of a new century.

Please enjoy the book.

Part I

Understanding Product Development in Today's Food Industry

Chapter 2

HOW DID THE FOOD INDUSTRY GET (FROM THERE) TO HERE?

Diane Toops

Why Read This Chapter?

Diane Toops provides you with a wonderful overview of the key benchmarks in the history of the food industry and gives you a rapid way to see that innovation is not new—but a path the food industry has been on for years and years.

This chapter discusses the events, technological innovations, trends, and consumer needs that led the food industry from “there” in the late nineteenth century to “here” in the twenty-first century. It also touches on the challenges and opportunities for product developers.

I track trends looking to the future, but looking back over the past 115 years has been quite an education and surprising as well. Some things never change; the overriding trends have been, and continue to be, convenience and good health.

A '50s child, I remember that my mom wore a dress and high heels while preparing dinner. She spent her entire day going to the butcher and grocer to buy fresh ingredients, cook them from scratch, and have a balanced meal ready precisely at 6:00 p.m., when my father arrived home from work. Fortunately, feeding my family is a great deal more convenient today.

We know the food industry does not lead trends, it responds to world events and consumer needs by developing innovative technologies and

foods that solve problems and deliver what the consumer wants. That is as it should be.

Turn of the Century

Before the turn of the twentieth century, America was a rural, farm-based economy. Seventy percent of the population, some 60 million Americans, farmed the land and most of them ate the vegetables they grew and livestock they raised (Food for Thought, 1998, pp. 1–8).

Today, almost 294 million Americans (USDA, 2004) can purchase an incredible variety of inexpensive foods at their local supermarket. Food processors, retailers, and a sophisticated distribution chain make that possible. In fact, American families last year spent just 10 percent of their disposable income on food (USDA, 2004). That's probably the lowest percentage in the world.

Looking in the Fridge

Let's compare the contents of the fridge today to those in 1918 (Frigidaire, 2003). Redefining home convenience, Frigidaire introduced the refrigerator in 1918. A peek inside shows everything is fresh, home-made, and nutritious and will quickly spoil (table 2.1). Today's mom has options; foods have a longer shelf life and are more conveniently

Table 2.1. Found in “the fridge.”

1918	2003
Bottle of milk (fresh)	Gallons of homogenized milk
Eggs	Eggs
Lard	Fat-free margarine
Cream	Flavored, nondairy creamer
Churned butter	Sports drinks
Homemade lemonade	Squeezable yogurt
Homemade cottage cheese	Colored ketchup
Apple butter	Salad in a bag
Homemade jelly	Ice cream
Fresh meat	Frozen TV dinners

Source: Frigidaire (2003).

packaged, and many foods no longer have to be refrigerated. Eggs are in both refrigerators, but today they might be organic, free-range, brown or white, pesticide-free, or enhanced with omega-3s. Certainly, they will not spoil as quickly.

American food professionals should pat themselves on the back. Through their innovations, products have extended shelf life, and foods are safer, more affordable, and available to people all over the world. That said, let's go back for a quick study of how we got from "there to here."

1889 to 1899—New Options for Mom

In the late 1890s, millions of immigrants poured in from western and eastern Europe, bringing new cuisines and recipes. The first transcontinental railroad transportation system was completed. To accommodate the needs of a growing population, manufacturing plants proliferated. As more people spent their day at work, entrepreneurs realized there was an opportunity to feed them, first from horse-drawn lunch wagons and later from restaurants and general stores. Convenience was the driving need.

Food technology was the vehicle. Mechanical refrigeration became possible because of a machine that liquefies air (Matranga, 1997). Canning improved when Campbell Preserve Co. invented a way to condense liquefied foods. Southern Oil Co. chemist David Wesson developed a new method for deodorizing cottonseed oil. "Wesson Oil" revolutionized the cooking oil industry (Bellis, 2004). Processed foods with longer shelf life began to appear in specialty grocery stores, and consumers enthusiastically embraced them.

As consumers sought reliability and quality from prepared foods, branding became important. National Biscuit Co. was formed, and the Uneeda Biscuit, the first branded cracker, was introduced. Campbell's canned soups debuted with striking red and white labels, in honor of the uniform colors used by the Cornell football team. Lawyers B. F. Thomas and J. B. Whitehead persuaded Atlanta pharmacist Asa Chandler to let them bottle his Coca-Cola fountain beverage in a uniquely shaped bottle (Food for Thought, 1998). Meanwhile, Caleb Bradham put together his secret ingredients for Pepsi-Cola. The Kellogg brothers used direct-mail marketing to sell their "healthy" corn flakes and Entenmann's delivered

baked goods directly to a customer's door. In a nutshell, mom wants convenience, technology solves the problem. She is satisfied with the brand and becomes a repeat customer.

1900 to 1910—Optimism and Prosperity

In fast-expanding cities, commercial food manufacturing and restaurant openings boomed. Eating abundantly meant you were prosperous, and the middle class beefed up on beef, chicken, and desserts.

As often happens, there was a reaction to this perceived gluttony. The Kellogg brothers and C. W. Post began a pure foods movement, saying that protein was not healthy and whole grains were the secret to mental and physical well-being.

In early 1900, William Fletcher, a doctor, and Sir Frederick Gowland Hopkins, a biochemist, separately discovered that certain foods were important to health and a lack of nutrients can make you sick.

British chemist William Normann developed the hydrogenation process for oil (Bellis, 2004). Hydrogenation converts mono- and polyunsaturated fatty acids from their fluid state to a harder fat, which raises the melting temperature and slows rancidity, resulting in foods with a longer shelf life.

Convenience drove innovation. Drip coffeemakers debuted, Hills Brothers began packing roasted coffee in vacuum tins, and instant coffee was invented. Canned tuna was first packed in San Pedro, California; Milton Hershey introduced the innovative Hershey bar; and Jell-O, everyone's favorite dessert, was available to all.

We leave 1910 with mom's desire for convenience still the main driver, technology that provides longer shelf life, and the awareness that the foods you eat affect your health.

1911 to 1920—Gearing Up

Two of the first home refrigerators appeared in Fort Wayne, Indiana, where in 1911, General Electric Co. introduced a refrigerator invented by a French monk (History of the Refrigerator, 2004). The first "Guardian" refrigerator—a predecessor of the Frigidaire—was manufactured in 1916 by the Guardian Refrigerator Co., which was acquired by General