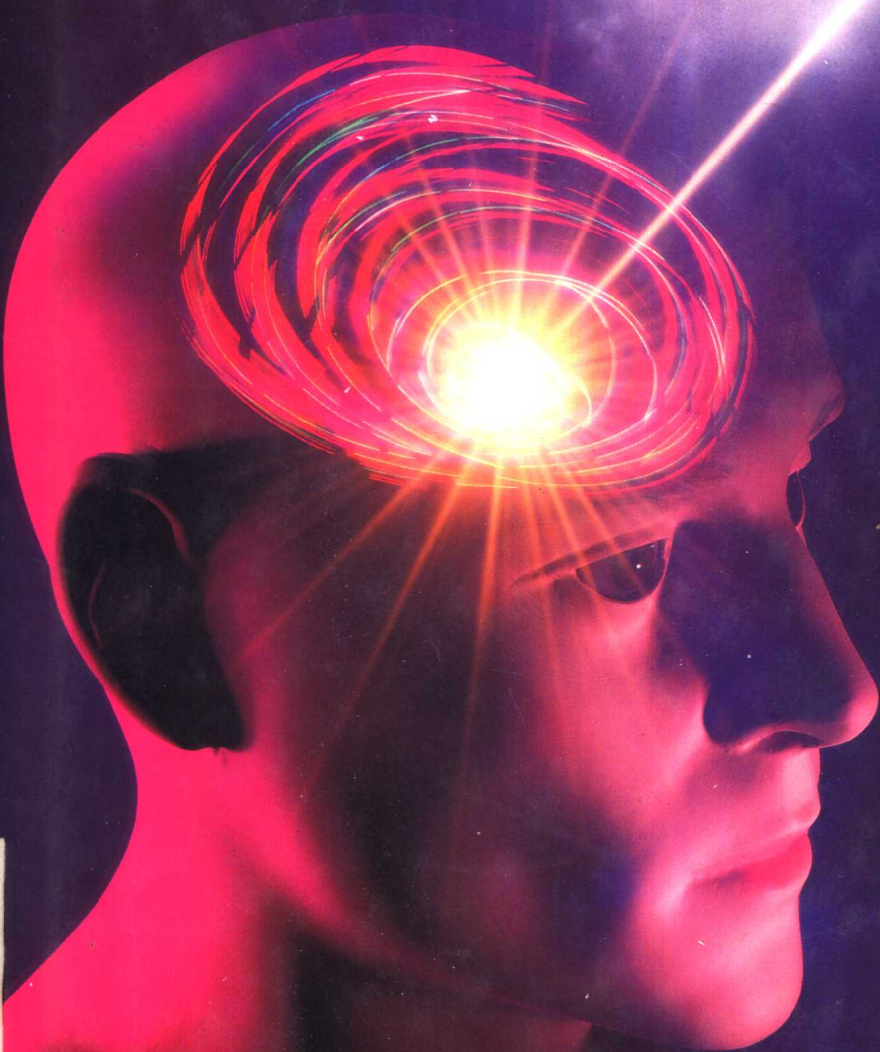


**A View of Business, Technology,
and Innovation in the Next 30 Years**

Recollecting the Future



Hugh B. Stewart

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PREFACE

“Stocks Plunge 508”

“Wall Street Panic”

“Stock Nose Dive”

“Market Meltdown”

Headlines following “Black Monday” echoed the same theme. But did Black Monday suggest another Great Depression? Did October 19, 1987, mark the end of an economically prosperous era?

For reasons to be explained in *Recollecting the Future*, we should indeed expect an economic growth “bust” lasting from 1988 to approximately 1995. Even the *average* GNP growth for that period can already be “recollected” within reasonable precise limits of uncertainty. Reasons for the growth bust can also be indicated—but not the more familiar ones.

Most significantly, 1987 should not be regarded only as the end of an era. That is not the theme of this book. Instead, equal emphasis is placed here on the emergence of a new growth boom—a boom that will have its genesis in the late 1990s. That boom will begin slowly but will gain momentum over the next two to three decades. It will be rooted in a burst of technology innovations and revolutionary new industries.

Why should *Recollecting the Future* be of interest to you? It focuses on business growths, not business busts. It discusses the ingredients of the long business-growth cycle. It indicates why and when the next boom will occur. And it identifies business- and career-growth opportunities we can expect in that boom. All of this is based on simple growth laws—growth laws that control our industry, our national economy, our national energy consumption, and our work force. It is an exciting story of the future based on nature’s growth formulas.

But why “Recollecting the Future?”

Surprisingly enough, in many cases we *can* recollect the future—where it involves growth. We know, for example, that the weight of a new-born child will approximately quintuple in its first five years. Or, as a longer-range recollection, we can be quite confident that a two-fold weight increase will occur between ages 10 and 20—an average growth increase of 7 percent per year (actually, somewhat different for boys and girls). These examples of “recollecting the future” are based on well-established “trends” of growth patterns for children. They are reliable because we know that nature has ordained a child’s weight to follow certain patterns. Nature has been equally unbending relative to other organic growth behaviors such as animal growths, vegetable growths, population growths in resource-limited environments, and even certain chemical reaction growths. Projections of growth behaviors for these cases, then, are not really *predictions*. Rather, we are remembering the past and are using that historical knowledge and data to know, relatively confidently, what will happen in the future.

Let’s suppose for a moment that various industrial growths or our nation’s economic growth could be found to follow well-defined growth patterns. Those growths, then, might also be amenable to recollections of the future. But if we are going to recollect, for example, the economic future, we will certainly be challenged to support those projections with sound reasons for our theories. Doing so is a goal of *Recollecting the Future*.

Recollecting the Future is essentially an application of trend analysis, just as projecting a child’s weight growth is based on actuarial trend analyses. Let’s draw an important distinction, though, between “trend analysis” as used here and the currently fashionable “trend spotting” used by a number of prestigious consulting firms. Trend analysis is firmly based on certain immutable growth laws of nature—growth laws that, for good reasons, might apply to a variety of industrial, societal, and economic growths as well as biological growths. Admittedly, growth behaviors are not always *precisely* repetitive. For example, the annual growth rate for children between ages 10 and 20 might be 7 percent on the average but vary between 6 and 8 percent for individual

cases. Business and economic growths will also be found to show well-defined deviation limits about a mean expected growth. Those well-defined limits only lend greater confidence to our ability to recollect growth patterns of the future.

In contrast to trend analysis, trend spotting is simply a judgment of societal directions based on public opinion polls, newspaper research, or personal observations. Hence, trend *spotting* is subjective. The trend is only as reliable as the judgment of the spotter. That is not to demean the practice of trend spotting. At best, though, trend spotting involves the careful sifting and interpreting of news information by experts, or presumed experts. Trend *analysis*, on the other hand, is objective. It depends on natural growth laws. The uncompromising behavior of growth allows us to avoid the necessity of sifting and interpreting data.

Growth laws generally depend on factors outside our judgment.

As will be seen in the following chapters, a surprisingly large number of societal trends are subject to simple growth laws—or in some cases, growth laws with well-defined idiosyncrasies. Possibly the most interesting and useful societal growth trend is that of our economy. Indeed, you might be more than a little curious to know, for example, the economic trends you can expect in the next 10, 20, or 30 years. What average annual GNP growth rate should you expect between 1988 and 1998? What growth rate should you expect between 2000 and 2020?

Your curiosity might even extend to probable technology, business, or career directions that will be important to you, whether you are a business manager, a business merchant, a career planner, or just a thoughtful person. What dramatic new technology directions should you expect in the next 10 or 20 years? How can your business prepare for these directions? What career planning should you be doing?

Recollecting the Future is unique, though, in at least three respects:

- It uses over 130 years of historical data on *gross national energy consumption* (GNEC), not just gross national product (GNP), to establish patterns of growth for “societal

industry” and “economic prosperity” in the U.S. (and the world).

- It uses the GNEC (and related GNP) historical growths to affirm the existence of a long economic wave which has an average period of about 55 years and a well-defined amplitude of variation, economic boom and bust periods are easily inferred.
- It directly relates technology-innovation surges, new-business growths, capital-equipment overexpansions, GNEC growth, and GNP growth in describing causes and effects of the long wave.

A primary goal of *Recollecting the Future* is to provide business people and general readers with a nontechnical digest of forecasting methods and conclusions that have frequently appeared only in technical journals and book. The concepts, methods and conclusions to be described include:

- technology innovation clustering
- S-growth adoption curves for new technologies
- energy/economic relationships
- capital overexpansion concepts
- the long economic wave

If you are not familiar with the terms, relax! *Recollecting the Future* will explain them for you, give concrete examples you can understand, and relate the concepts to situations you face in your own business and personal life.

The sometimes dry economic and mathematical background behind the subjects is omitted here, except for some information in the appendixes to satisfy the more mathematically curious readers. Your understanding of how you might be affected by the long economic wave should not be impaired by that omission.

To paraphrase the famous philosopher-scientist C. P. Snow, our society is evolving more and more into two cultures. In this case, one culture embraces the scholars and teachers who develop the theoretical background and models used in understanding our complicated industrial society. The other culture consists of business pragmatists who, unfortunately, are all too often unfamiliar with much of the interesting and potentially useful work coming

from the other community. *Recollecting the Future* will allow you, the business pragmatist, to recognize, appreciate, and utilize more effectively the important contributions coming from the intellectual culture.

Briefly, then, this book is written to help you in your business and personal life. It explains, in layperson terms, how basic technology innovations come in clusters, how these innovation clusters lead to a swarming of business growths, how that growth swarming creates a long economic wave, and how you can recognize and use the long wave in your own personal planning.

Are you ready to recollect the future? Chapter 1, "The Future as It Was," will first review how this sequence of events unfolded in the last 100 years.

Hugh B. Stewart

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The attempt to write a reader-friendly and informative book on the projectability of technology, business, and economic growths has been a formidable challenge. In that endeavor I am deeply appreciative of the excellent help I have had.

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H. B. S.

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PART 1

THE PATTERNS OF GROWTH

CHAPTER 1

THE FUTURE AS IT WAS

In 10 years, one of the most remarkable revolutions this country has ever seen will begin. It will *not* be a political revolution. It will be a revolution in technology, in economic growth, and in our social system.

What can we expect from this revolution in technology? In only 40 or 50 years, you or your children will think no more of taking a trip across the country than of traveling to a neighboring city. You will be able to watch a symphony concert in your own living room and the sound will compare to that reaching the fifth-row seats of the symphony hall. An entirely new frontier will be opened—a space frontier. You will experience a new “plastic era,” that results in an almost complete substitution of synthetic materials for natural material resources. You will see new medicines and health care that add at least 10 years to the average American’s life expectancy.

Beyond the technology revolution, what *economic* revolution can be expected? After five to ten years of economic doldrums, an economic growth will begin that will stagger your imagination—and that growth will continue for at least three decades. It will build on an industrial and business surge that results largely from the new technologies already indicated.

What is the *social* revolution? With an industrial surge of almost incredible proportions, the labor classes will share the luxuries previously reserved only for the wealthy. Large numbers of professional women will join men in the workplace. Startling new social programs will be implemented, some of which will benefit a rapidly growing number of elderly people.

Is this the future of tomorrow? No, that future will be even more exciting. This is “the future as it was”—a future projected from the depths of the depression in the 1930s. It was a future based on technologies yet to come, including:

- jet-air travel
- television and hi-fi sound systems
- the Apollo space program
- nylon, polyester, and acrylics
- antibiotics, new vaccines, and advanced clinical testing

Revolutions in technology and their consequences are not new. In fact, an equally dramatic future-as-it-was scenario could have been developed from the perspective of the 1880s. During this period another spectacular surge of major technology innovations occurred, including:

- automobiles
- electrification
- telephones
- photographic films

Those particular innovations of the 1880s (as well as the ones in the 1930s) were so influential in subsequent industrial and business growths that they will be referred to as “macroinnovations.” The intent is to draw a clear distinction between them and the more popularly discussed “innovations.”

Recollecting the Future is an account of how technologies, businesses, the national economy, and job opportunities grow—and how we can project those growths. It is based on simple principles of growth behaviors. The growths of technologies and the national economy follow a surprisingly consistent pattern of evolution—a pattern of *successive revolutions*.

Recollecting the Future describes those growth patterns—patterns that can allow you to project future growths.

Why should you be interested in this exercise in prognostication? Because *Recollecting the Future* can be applied to your own personal and business interests. Purely as a matter of risk aversion, you should be interested in the timing and extent of an unfolding economic growth bust—a growth bust made more omi-

nous by the Crash of 1987. You should be interested in the timing and extent of a growth boom and concerned about your business and how it will grow (or decline) in this growth wave, which is projected to begin in 10 to 15 years. The growth of your own career prospects—where opportunities will occur and when—should interest you, and even if you are comfortable with your own career choice, you may want to know how to guide your children. Clearly, these concerns involve the future and the aim of *Recollecting the Future* is to address these and other issues of the future.

The patterns of important growth trends will be described (and quantified) in the first two parts of this book. Based on a knowledge of those patterns, the last half of the book will launch excursions into the future.

A subtle, but important, point should be recognized at the outset. Most of our business and personal decisions are generally made as *responses*—responses to events of the times. This book also proposes approaches that allow decisions to be based on responses, but in this case responses to recollections of the future.

As a first step toward recollecting patterns of the future, let's examine the future as it was at two particularly exciting periods—1900 and 1955.

The Future as Viewed from 1900

Our grandparents saw enormous progress between 1900 and 1930—progress in technology, the economy, and social well-being. Let's assume your grandfather's birth coincided with the 1880 macroinnovation surge, and he was just entering his independent working years in 1900 at the age of 20. He and his colleagues would have shared the following characteristics:

- only 6 percent had completed high school
- less than 2 percent were destined to finish college
- 38 percent would become farmers
- 45 percent would become laborers
- only 17 percent would enter white-collar jobs

The wave of technology macroinnovations had been initiated around 1880, but in 1900 your grandfather's home was still not electrified. He probably had no telephone service—only 5 percent