

Cambridge University Press

978-0-521-55299-8 - Technological Innovation: Oversights and Foresights

Edited by Raghu Garud, Praveen Rattan Nayyar and Zur Baruch Shapira

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# Technological innovation

Oversights and foresights

*Edited by*

Raghu Garud

Praveen Rattan Nayyar

Zur Baruch Shapira

*New York University*



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## Foreword

*James G. March*

This book is about technological innovations. It is set against a background of contemporary technological turbulence and numerous attempts to describe the genesis of various changes in technology that have been observed. It represents an attempt to make sense of the technological dynamism that appears to be endemic to the times and to provide some plausible suggestions for managing it.

The task is not an easy one. In particular, it is a task that is complicated by the conspicuous importance of technological innovation to modern life. There is no shortage of stories of innovation. They fill biographies, the popular press, and the after-hours conversations of participants. These stories have certain similarities. Changes in technologies, practices, and products are characteristically described in terms of the triumph of the new over the old. Initially, a new idea, institution, or practice is introduced into a small part of the system. Ultimately, it becomes pervasive. The stories use the powers of retrospection to identify individual and organizational genius in this triumph of good over evil.

The obvious difficulty with these stories is not so much that they can be demonstrated unambiguously to be false as it is that *even if they were false* we would nevertheless construct and repeat them. The market for stories of individual and collective triumph is insatiable, and anthropomorphic biases in human storytelling and comprehension are legendary. As a result, the fact that the tales of innovation that are told seem to have a consistent structure is hardly compelling evidence for their validity.

The present book tries to bring a certain open-mindedness to those stories, an open-mindedness that is skeptical about received truths but willing to entertain the possibility that there is some connection between popular stories and a serious theory of innovation. It focuses more attention than is usual on the failures of innovation, exploring the theoretical and engineering implications of the fact that the process of innovation generates failures much more frequently than it does successes. The contributors examine the extent to which it is possible to use ideas drawn from a contrast between in-

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novative failure and innovative success as a basis for increasing the frequency of success. They differ a bit on whether such an increase is possible, but those differences are probably less significant in the long run than are the ways in which the studies illuminate our thinking about learning, discovery, and knowledge.

Many of the chapters can be seen as variations on a theme of organizational learning and its problems, particularly two central complications in adaptation through learning. The first is the difficulty of specifying the optimal allocation of resources between exploiting and developing what is already known and exploring what might come to be known. Defining an optimum involves trade-offs across time and space that are exceptionally difficult to calibrate. The second is the difficulty of avoiding dynamic imbalances between exploitation and exploration. Experiential learning processes, for example, tend to drive out exploration. Much of the richness of the book lies in the careful delineation of the many considerations involved in understanding and managing that balance. The chapters describe various forms of a dialectic between discipline and imagination that is reminiscent not only of Schumpeterian economics but also of theories of creativity in art and poetry.

It would, however, be a mistake to locate the book exclusively in a context of contemporary technology and contemporary economic organizations. Stories of innovation are not unique to studies of technological change. They are also characteristic of histories of ideologies, political systems, technologies, scientific knowledge, and breakfast cereals. And although the things that are specific to specific technologies and particular times are clearly important, so also are the things that inform our interests in history more generally.

As a result, the book is also a book in pursuit of a theory of history. Historians are notorious for their inclination to quarrel over what a theory of history should comprise, indeed over whether such a thing is imaginable; but there is little disagreement over the proposition that the world changes. History records numerous transformations of cultures, political and economic systems, organizations, and groups. The study of history is concerned with recording, interpreting, and understanding those changes.

The present contributors, for the most part, share with most other modern students of history a perspective on historical change that is broadly evolutionary. That is, the meanderings of history are assumed to have three central attributes: First, they are strongly inertial. Many of the processes of historical development reproduce existing structures, beliefs, and practices. Second, they produce a modest flow of experiments with deviant structures, beliefs, and practices. Third, any successful substitution of a new structure, belief, or practice for an old one is more likely to improve a culture's match with its current environment than it is to degrade that match. Within that broad frame there is plenty of room for disagreement, particularly over such things as the extent to which the process ever approaches an

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equilibrium, whether the equilibrium is uniquely implicit in the environment, and whether the environment is similarly developing at the same time.

The weakest part of historical theories within this variation–selection–retention tradition is the treatment of variation. In classical Darwinian versions, mutations are treated essentially as inexplicable, random curiosities, some extremely small fraction of which turn out to provide some survival advantage. Some of the contributors to this volume, along with some of their colleagues not represented here, are (more or less) Darwinian in the sense that they see no serious evidence that any process that generates innovations has any capability for prescreening them intelligently. Put another way, they see the processes that produce those few innovative ideas that subsequently thrive to be essentially indistinguishable from the processes that produce those many innovative ideas that subsequently disappear. The difference between madness and genius is in the unpredictable certification of history.

For this group of contributors, there is no question of improving the innovative yield of the processes of history. They argue that the powerful vividness of their experiences with innovative success blinds participants and observers to the fact that “truly” innovative success is associated with changes that appear crazy to any well-informed person *ex ante*, thus with changes that will be eliminated by any attempt to introduce deliberate management of innovative change. From this perspective, it is possible to vary the amounts of resources and energy that are devoted to craziness and thus to vary the rate of innovation; but any attempt to improve the yield is counterproductive.

Most of the contributors to this volume, on the other hand, are (more or less) Lamarckian in the sense that they see innovations and history as attributable to willful human action and possibly susceptible to some degree of intentional management. They try to understand what makes an innovation successful (or alternatively what leads an organization to discover or create an innovation that will be successful). In more general terms, they reflect somewhat greater optimism than their colleagues about the possibilities for shaping and predicting historical change.

The conflict between the Darwinian Tolstoy and the Lamarckian Carlyles of the world is not resolved here. Rather, these two poles are used to inform a more textured view of change; one that is filled with the concrete realities of specific situations and with a conception of the possibilities for meaningful engineering intervention without necessarily being able to predict historical development.

So, the book, as advertised, is about technological innovations; and it can be read with profit by anyone interested in how such innovations can be understood and shaped. From a rich base of empirical cases and theoretical frames, the authors produce a portrait of modern technology and its development in a (predominately) democratic political system and a (predomi-

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nately) market economy. But the book is simultaneously a book about history, particularly about the ways conscious actions, intentions, luck, and knowledge affect the course of history. Many of the ideas could as easily be used to talk about the development of religious movements, political institutions, or scientific paradigms.

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## Preface

Ideas beget ideas. This adage captures both the genesis of this book and its central theme. It all began when Avijit Ghosh, then Director of the Center for Entrepreneurial Studies at the Stern School of Business, New York University, called to ask if we would be interested in exploring entrepreneurship using a technology lens. Having already spent time exploring the notion of oversights and foresights, we quickly decided that exploring entrepreneurship through a technology lens would be a fruitful endeavor, especially if it were to be a cross-disciplinary one.

Deciding to put together a collection of thought-provoking ideas on this subject, we contacted many leading thinkers from several disciplines. We were gratified by the overwhelmingly enthusiastic response. Rather than ask each author to contribute independently, we concluded that it would be productive to organize a workshop where ideas could generate ideas.

To emphasize the multidisciplinary nature of the phenomenon, we organized the workshop by major “disciplines” that we had identified (technology, marketing, decision making, organizational processes and strategy). Our strategy was to bring together leading thinkers in each of these disciplines and ask them to present their ideas at the workshop so that contributors could get a more holistic perspective. We wanted each participant to have an opportunity to benefit from this cross-pollination process. Consequently, we decided to hold each presentation sequentially. In addition to the presenters, each session had a chairperson and a discussant. We requested discussants to address papers contained in each session both individually and collectively. We kept the task of integrating the papers across disciplines to ourselves.

Ideas generated ideas at the workshop. Each paper pointed to a facet of the phenomenon that was different yet complementary. Discussants’ comments were invaluable in pointing out how papers could be modified to enhance their value, both individually and collectively. Conversations be-

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tween participants offered an additional means for the exchange of ideas. Some of these ideas were solidified in an after-dinner speech by John Seely Brown who shared the practical aspects of dealing with oversights and foresights.

After the workshop, we decided to divide the editorial work. Each contributor was assigned an editor from amongst the three of us. Besides discussants' comments, we also offered authors feedback on (1) literature and comments that could be used to enhance the value of each manuscript, (2) modifications that would tie the manuscripts together with respect to the overall theme of the book, and (3) a synopsis of the core propositions contained in other manuscripts so that authors could modify their own manuscripts to create a truly interdisciplinary book.

Even as we offered feedback, we began realizing the limitations of a book on innovation organized by disciplines. Such an organizing scheme, we found, created more of an artificial disciplinary barrier to a phenomenon that is truly interdisciplinary. Consequently, we began trying different ways of organizing the book. For instance, we tried to organize the book by "levels" of analyses, but then soon found that many papers, and indeed the phenomenon of interest, cuts across levels. The current scheme, although committing a "procrustean transformation" in its own way, represents to us the elements of a theory of innovation.

As we experimented with the arrangement of the chapters in the book, we simultaneously experimented with its title. At first, we chose the title "Technological Oversights and Foresights." We soon discovered that this title, by itself, suggested that we and our contributors were looking at technological outcomes that, only in hindsight, could be defined as oversights or foresights. After experimenting with a few more titles including one that had entrepreneurship in it, we finally settled on the title "Technological Innovation: Oversights and Foresights."

In the title, as in the rest of the book, we use "innovation" to suggest that it is as much of a process as it is an outcome. Such a dual meaning for innovation is similar in intent to the dual meanings associated with words such as "building," "construction," and "work," designating both a process and its finished product (Dewey, 1934). As Dewey explains, for these words, "Without the meaning of the verb that of the noun remains blank" (Dewey, 1934, p. 51).

In a similar vein, although innovation is often thought of only as an outcome, we use the word to mean process as well. In particular, learning can render technological innovation a process that is systematic, enacted, unconstrained, and manageable. Without learning, however, ideas do not foster ideas, and, innovation remains an outcome of technological choices similar to outcomes associated with the flip of a coin.

In reaching this central theme, we have made many demands on our patient contributors, some of whom have revised their chapters more than once. These are the "visible" colleagues in this book. The discussants and

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chairpersons who made valuable contributions are the “invisible” ones. The discussants were Linda Argote, Frances Milliken, James Utterback, and Sidney Winter. The chairpersons were John Dutton, Charles Fombrun, Avijit Ghosh, George Smith, and Jon Turner. In inaugurating the workshop, George Daly set the stage for the discussions to follow. Others who contributed at the workshop include Meg Graham, Dorothy Leonard-Barton, Joseph Litterer, Mike Rappa, Bill Starbuck, and Sarah Tabler. We thank them.

Of course, there were many others whose ideas, commitment, and energy made this book possible. Prime among them are Patricia Edwards and Loretta Poole of the Center for Entrepreneurial Studies who took it upon themselves to orchestrate the entire workshop. Besides the services of Pat and Loretta, the Center also generously extended financial support, making the workshop and the book possible. Our immediate colleagues Roger Dunbar and Arun Kumaraswamy have influenced us immensely in the way we have thought about these issues. The editor at Ampersand, Paul Schwartz, deserves a special word of thanks, as do Rebecca Gallin, Harry Wang, and Joy Turnheim of NYU for helping with the editorial work and the cover design. Karen Angelillo, Gia Pangilinan, and Alaine Robertson also gave freely of their time.

There were many at Cambridge University Press who believed in our project and actively and patiently cheered our progress. We thank them, especially Julia Hough.

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