

Bridging Islands

*Venture Companies and the Future of Japanese and
American Industry*

ROBERT KNELLER

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This book is dedicated to the men and women in universities, technology management offices, venture businesses, venture capital companies, established corporations, and government, who are empowering scientists, engineers, and business managers to chart their professional development, expand their professional networks, and thereby to discover new outlets for their energy and creativity and to have more fulfilling and productive careers.

Preface

This book compares the role of venture companies¹ in early stage innovation² in new fields of science and technology in Japan and the USA. Its basic conclusion is that new companies are vital to discovery and early development in many new fields of science and technology, and thus they are vital for any industrially advanced nation whose companies seek to be competitive in new fields of science and technology. Ventures are particularly important as bridges between university discoveries and the established companies that usually undertake final commercialization of such discoveries. They are also important for the development of technologies arising in established companies that the latter, for one reason or another, do not develop.³ The US case illustrates the importance of ventures, as well as the many preconditions for ventures to be engines of innovation.

Japan's case is interesting because at first glance it may appear that its manufacturing companies rose to the forefront in high technology fields primarily on the basis of in-house R&D, or through cooperation with affiliates within their manufacturing keiretsu.⁴ Cooperation with universities was limited primarily to absorbing findings from a large number of small research projects and picking the brains of leading professors.⁵ Cooperation with new, independent, domestic ventures is minimal, even today.⁶

However, in machine tools and other engineering-related fields, many companies were incorporated in the 1950s through 1970s. When they were young, some of these companies experimented with new technologies, devising new products as well as novel applications of the new underlying technologies.⁷ Even after they matured, some were encouraged to innovate in areas beneficial to a main manufacturer's business. Thus innovation in new or small companies may have been a major factor in Japan's economic miracle. However, new high technology companies and small companies innovating in new fields of technology seem rare in 2006. This book explains why this was so and why, despite concerted efforts by the Japanese government to improve the environment for ventures, most ventures today are struggling and play only a peripheral role in Japanese innovation. It also shows why, in view of institutional and social factors, this situation is unlikely to change significantly in the near future.

However, the last two chapters present cases and some comprehensive data from several industries to suggest that it is dangerous for Japan, or any other industrialized country, to rely solely on established companies for innovation

in new fields of technology. Although its established manufacturers may try to shore up their innovation capacity by increasing collaborations with universities, emphasizing a black-box innovation strategy,⁸ or relying on spin-offs or other affiliated companies,⁹ these strategies cannot substitute for the lack of new, entrepreneurial, independent companies that will take the first risky, crucial steps to develop new technologies. Without new high technology companies, Japan, and other advanced industrial countries that rely mainly on large established companies for innovation, risk being squeezed between countries that can rely on new companies to bring new technologies to proof of concept stage quickly, and countries where manufacturing can be done at lower cost with almost the same level of quality.

Confronted with this dilemma, Japan and similarly situated countries must try to improve the environment for high technology ventures, without distorting market incentives or attempting radical transforms of their innovation systems. In Japan's case, it so happens that opportunities for reform still remain, especially in the field of university–industry relations. The last pages of this book suggest reforms that would help level the playing field between large and new companies with respect to access to university discoveries. In the process they would probably also increase the quality of university scientific research.

As for the USA, another thesis of this book is that the degree to which America relies on venture companies to remain a global innovation leader is probably not generally appreciated. Moreover, as a mirror image of Japan, the ability of America to change quickly to rely more on its established companies for innovation is also constrained by deeply rooted institutional and social factors. Therefore, the economic vitality of America depends upon maintaining a supportive environment for its venture companies. This requires many factors to fall into place. There are many ways a supportive environment can be ruined. There are only a few ways to succeed. In this regard, perhaps one of the primary social and economic benefits of a strong effective patent system, of the American-style system of university–industry technology transfer, and of the so-called system of liberal market capitalism, is that they are all essential for the birth and growth of venture companies. Any change to these systems should not undermine their benefits to new high technology companies.

These are sweeping conclusions for which I tried to provide evidence in the book. However, there is much about innovation in Japan, the USA and other countries that I do not know. Working across language and geographic divides has been challenging. I have tried to find the main Japanese language information sources, but because I read Japanese more slowly than a native speaker, I may have overlooked important sources. I have a unique insider's window on how Japanese science and business is evolving. But I see only part of the whole, and I am not an insider in the sense of being privy to discussions

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that shape innovation policies in companies, government, or academia. Separated by distance from US companies, I often felt uncomfortably reliant on secondary sources for information on actual conditions in corporate America. Finally, because of time constraints, I have not expanded some of the analyses in this book to the degree I would like.¹⁰

In writing this book, I was constantly trying to achieve an appropriate balance between circumspection regarding my conclusions, and stating them clearly, sometimes provocatively. Although I have tried to point out areas of doubt as well as contradictory information, nevertheless I may have erred more often on the side of provocation than circumspection. This not because I am absolutely sure about my conclusions. Rather, by stating controversial points clearly, I hope to generate discussion about topics that are important for all countries that seek to improve their innovative capabilities and the opportunities for their scientists, engineers, and corporate managers for fulfilling, productive work. If some of my assumptions or conclusions are in error, I hope readers will come forward with information to correct them. If this book does only this, writing it will have been worthwhile.

Three additional points should be mentioned, relating to style, focus, and how I came to write this book and the persons that helped make it possible.

I have written the book so that it can be read on two levels. Reading without references to footnotes will, I hope, enable readers to understand the main points and main lines of argument easily. For this reason, I have purposely avoided almost all references in the text to the work of other researchers, detailed data, etc. My intention is that reading without footnotes will make the book interesting and accessible to a wide range of readers. However, it was essential to indicate supporting information for statements in the text, to acknowledge the contributions of others (without which this book could not have been written), and to provide relevant details and nuances. Therefore I have used footnotes liberally. I hope persons who are interested in supporting information and a greater level of detail will find this system of footnoted information satisfactory.

This book was originally conceived as a three way comparison of Japan, the USA, and Continental Europe. However, I soon realized that it would be too great a challenge to acquire information on Europe that would enable the same focused comparisons that I felt were essential to make between Japan and the USA. Nevertheless, Europe as well as China, India, and Korea were never far from mind, and I made reference to them when it seemed appropriate. The final chapter suggests that there are many similarities between Japan's innovation system and that in Korea and some countries of Continental Europe. Perhaps researchers in these countries will analyze those similarities more thoroughly.

I arrived as an Abe Fellow at the University of Tokyo in 1997 to study the Japanese system of university–industry cooperation. Previously, I had worked in cancer epidemiology and then science policy and technology transfer at the National Cancer Institute of the US National Institutes of Health (NIH). I was invited to join the faculty of the University of Tokyo in 1998. Some of my closest colleagues have been scientists and engineers in Research Center for Advanced Science and Technology (RCAST), an interdisciplinary research center in the University of Tokyo; a small group of RCAST scholars in intellectual property, science policy, and innovation; and staff of the University’s main technology licensing organization. My initial research focused on the system of university–industry collaboration, particularly the ownership and management of university inventions. Discussion of the need to change this system had just begun when I arrived in 1997. Since then the system has changed dramatically, in form if not in actual effect. With the initial technology transfer reforms came discussions about the need for more university ventures—a topic I was already interested in from my years in NIH. By 2000, I was interviewing biomedical ventures (approximately one per month) to understand how they obtained personnel, financing, core technologies, IP rights, and customers. I was also interviewing pharmaceutical companies to understand the origins of their new drugs. This book brings together these three strands of my early research in Japan: university–industry cooperation, innovation in pharmaceutical companies, and the challenges and opportunities facing venture companies. However, in order to write this book and to compare transnationally the importance of venture companies and their environments, I had to broaden the scope beyond biomedicine and beyond the university–industry relationship.

I am extremely privileged to have had this opportunity to pursue in-depth research over a long period into a topic that combines science, medicine, law, business, public policy, economics, education, and cross-cultural studies. I am grateful to all the persons and organizations that made this possible including the Japan Foundation and its Abe Fellowship Program; the University of Tokyo and in particular RCAST which has been my institutional home for nine years; Professor Fumio Kodama who warmly received me in his RCAST laboratory as an Abe Fellow; Professor Katsuya Tamai and Professor Etsuo Niki (the director of RCAST when I arrived) who were instrumental in arranging the faculty appointment at the end of the Abe Fellowship; Professors Teruo Kishi, Yoichi Okabe, Takashi Nanya and Kazuhito Hashimoto, also former directors of RCAST who have been supportive of research; my other colleagues in the University of Tokyo who have shared with me their time, insights, and friendship; and the Ministry of Education, Culture, Sports, Science and Technology (MEXT) for providing Grants-in-aid that have greatly facilitated my research.

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I hope this book, in some small way, justifies the opportunity these persons and organizations granted me and returns a small portion of the benefit I have received. In this regard, I hope the perceptions and suggestions offered in this book will be regarded as the attempts of someone who cares about Japan and America and feels deeply indebted to both countries to offer constructive perceptions and suggestions for change. If I have missed the mark, the responsibility is my own, and I can only request the understanding and forbearance of the persons and organizations that made possible my research.

I have served as an adviser for several Japanese biotechnology companies, a venture capital company focused on the founding of biomedical ventures, a university technology transfer office and a company that facilitates the growth of ventures through advice to the ventures and potential investors. From all these relationships, I probably have gained more in terms of insights into the actual conditions of venture companies than I have given in the form of advice.

I am also grateful to many persons in businesses, government, and other academic institutions in Japan who have shared information and insights. I especially appreciate the corporate managers and scientists who granted formal interviews over the past seven years, some of which are presented in this book as case studies. In the case of the non-biomedical ventures, I appreciate the cooperation of the Fujitsu Research Institute (FRI) in arranging these interviews, and the willingness of FRI officials to assist me on other topics related to this book.

I owe special thanks to Professor Richard Whitley of Manchester University Business School for taking an early interest in my early research, encouraging me to develop my findings into a book and providing ongoing counsel.

I am grateful to Jon Sandelin and others in US universities who have provided information and guidance. There are many others in US companies and US government institutions such as NIH and NSF who have provided helpful information. The NSF Tokyo Regional, in particular Ms Kazuko Shinohara, has been particularly helpful and a great source of information related to science and technology in Japan and other East Asian countries.

I am very grateful to Ms Makiko Hojo who has helped me find, scan, and interpret many of the Japanese language documents this book relies on.

Finally, words cannot express the gratitude I feel towards my wife, Sachiko Shudo, and our two daughters for their forbearance and support over the four years it has taken to write this book, and also for Sachiko's advice. When I began writing, I did not realize how consuming a project this would be. Their affection and presence as I wrote and researched day by day was both a reminder of their forbearance and encouragement to press forward. As my wife is a linguist, I was additionally blessed with her insights on Japanese

society and how to interpret the nuances in the various sources of information that contributed to this book.

NOTES

1. Throughout this book, I use ventures as shorthand for new independent technology-oriented companies. They may have relied on equity investments (e.g. from venture capital companies and individuals) for financing, but not necessarily.
2. By *early stage innovation*, I refer to the discovery and early stage development of new products or manufacturing processes based on new fields of science and technology, or new applications of existing fields of science and technology to discover or develop new products or Processes.
3. Provided skilled employees of established companies are relatively free to leave to join new companies.
4. Keiretsu are discussed in Chapter 6. The term literally refers to *linked* companies. Bank keiretsu are linked through common reliance on a large bank for a large proportion of their loans. The importance of this linkage has declined since the late 1990s. Manufacturing keiretsu are companies linked through a large, common end product manufacturer, the archetypal examples being keiretsu associated with the major auto manufacturers. These ties are probably still important in determining the business and innovation focus of the smaller keiretsu members.
5. In other words, with the exception of some large government-funded applied, consortium research projects in which universities were major participants, the universities' role in this process was largely passive. Even in the case of the government applied research projects, there was little entrepreneurialism in the sense of universities as institutions trying to attract research funding. The degree of pro-active involvement by individual professors probably varied. On the one hand, entrepreneurial incentives such as patent royalties and funds to recruit more graduate students and other staff were extremely limited. However, there are examples of professors working closely with companies and contributing to innovation.
6. More precisely, as shown in Chapters 4 and 7, such collaborations take a long time to work out and must overcome high bureaucratic hurdles within the large company.
7. In the case of machine tools, this was compact computerized numeric control devices.
8. By this I mean seeking to remain dominant in fields of manufacturing that require a high degree of non-codified, experience-based, process-specific, and sometimes delicate, art-like knowledge that is easy to keep in house and shield from rivals.

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9. All of which strategies established Japanese companies are currently trying.
10. For example, I would like to expand the number of technology fields in the patent analysis in the next chapter; extend the analysis of University of Tokyo, Keio and AIST ventures through 2005 (Chapter 3, appendix); extend the analysis of high technology companies that have had IPOs to cover more years than 2000–4 (Chapter 5); include new drugs approved by the FDA in 2004 and 2005 in the analysis of the origin of new drugs (Chapter 7), and examine more infringement and unfair competition cases to really nail down the issue of whether the IP judicial system meets the needs of ventures (Chapters 4 and 7).

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