Science, Technology and Society in Contemporary Japan

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SCIENCE, TECHNOLOGY AND SOCIETY IN CONTEMPORARY JAPAN

This book explores the dynamic relationship between science, technology and Japanese society, examining how it has contributed to economic growth and national well-being. It presents a synthesis of recent debates by juxtaposing competing views about the role and direction of science, technology and medical care in Japan. Topics discussed include government policy, the private sector and community responses; computers and communication; the automobile industry, the aerospace industry and quality control; the environment; consumer electronics; medical care; and the role of gender. This is an ideal introductory text for students in the sociology of science and technology, the history and philosophy of science, and Japanese studies. Up-to-date research and case studies make this an invaluable resource for readers interested in the nature of science and technology in the twenty-first century.

Morris Low has taught at Monash University, the Australian National University, and is currently a senior lecturer at the University of Queensland. His other works include the recently completed *The Historical Dictionary of Japanese Science and Technology* (forthcoming), as well as special issues of the journals *Osiris* and *History and Anthropology*. **Shigeru Nakayama** taught at the University of Tokyo before becoming Professor at Kanagawa University. A leading historian of Japanese science, his previous publications include *Science, Technology and Society in Postwar Japan* (1991). **Hitoshi Yoshioka** has taught at Wakayama University and is currently Professor at Kyushu University. He has published extensively in Japanese, including *The Social History of Atomic Energy* (1999). This is his first book in English.

CONTEMPORARY JAPANESE SOCIETY

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Abbreviations

AEA	(United Kingdom) Atomic Energy Authority
AEC	(United States) Atomic Energy Commission
AIDS	Acquired Immune Deficiency Syndrome
AJEI	Australia–Japan Economic Institute
ASEAN	Association of South-East Asian Nations
ATR	Advanced Thermal Reactor
CD-ROM	Compact Disk Read-Only Memory
EMAS	Eco-Management and Audit Scheme
ERA	Engineering Research Association
FBR	Fast Breeder Reactor
FEO	Federation of Economic Organisations (also known as *Keidanren*)
FRG	Federal Republic of Germany
FS-X	Fighter Support Experimental
FY	Fiscal Year
GATT	General Agreement on Tariffs and Trade
GNP	Gross National Product
HIV	Human Immunodeficiency Virus
IAEA	International Atomic Energy Agency
ICOT	Institute for New Generation Computer Technology
ISAS	Institute of Space and Aeronautical Science/Astronautical Science
ISO	International Organisation for Standardisation
ITA	Industrial Technology Agency
JAEC	Japan Atomic Energy Commission
JAERI	Japan Atomic Energy Research Institute
JAFC	Japan Atomic Fuel Corporation
JAIF	Japan Atomic Industrial Forum

JAPCO	Japan Atomic Power Company
JIS	Japanese Industrial Standards
JNSDA	Japan Nuclear Ship Development Agency
JSC	Japan Science Council/Science Council of Japan
JUNET	Japan University Network
JUSE	Japanese Union of Scientists and Engineers
KDD	Kokusai Denshin Denwa
KEK	National Laboratory for High Energy Physics
LDP	Liberal Democratic Party
LSI	large-scale integration
LWR	Light Water Reactor
MHD	Magneto-Hydrodynamic
MITI	Ministry of International Trade and Industry
MS-DOS	Microsoft Disk Operating System
NAMCO	Nihon Airplane Manufacturing Corporation
NASDA	National Space Development Agency of Japan
NEC	Nippon Electric Company
NGO	Non-Government Organisation
NHK	Japan Broadcasting Corporation
NIEs	Newly Industrialised Economies
NISTEP	National Institute of Science and Technology Policy
NSF	National Science Foundation
NTSC	National Television Systems Committee
NTT	Nippon Telephone and Telegraph
ODA	Official Development Assistance
OEM	Original Equipment Manufacturing
OTCA	Kaigai Gijutsu Kyōryoku Jigyōdan (later known as the Japan International Co-operation Agency)
PCDD	polychlorinated dibenzo-p-dioxins
PNC	Power Reactor and Nuclear Fuel Development Corporation
PVC	polyvinyl chloride
QC	quality control
QCC	quality control circles
R&D	research and development
S&T	science and technology
SCI	*Science Citation Index*
SDF	Self-Defence Force (of Japan)
SDPJ	Social Democratic Party of Japan
STA	Science and Technology Agency
STC	Science and Technology Council
TRON	The Real Time Operating System Nucleus
UNCTAD	United Nations Conference on Trade Development
USSR	Union of Soviet Socialist Republics
VLS	very large-scale integration

Figures

Tables

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Romanisation generally follows that found in Masuda Koh (ed.), *Kenkyūsha's New Japanese–English Dictionary*, 4th edn, Tokyo, Kenkyūsha, 1974. Elongated vowels are indicated by lines over the vowels. Japanese family names precede given names in the text unless the person has been a long-term resident overseas. The names of the authors of this book are, however, given in Western order for ease of reference.

Since 1949 the yen was fixed at 360 yen per US dollar. In 1985 the yen was allowed to appreciate, rising from 260 yen to 130 yen to the dollar by 1987. Since then the exchange rates have fluctuated. In June 1999 the rate was 122 yen. Amounts in US dollars given in the text are those provided by the sources cited.

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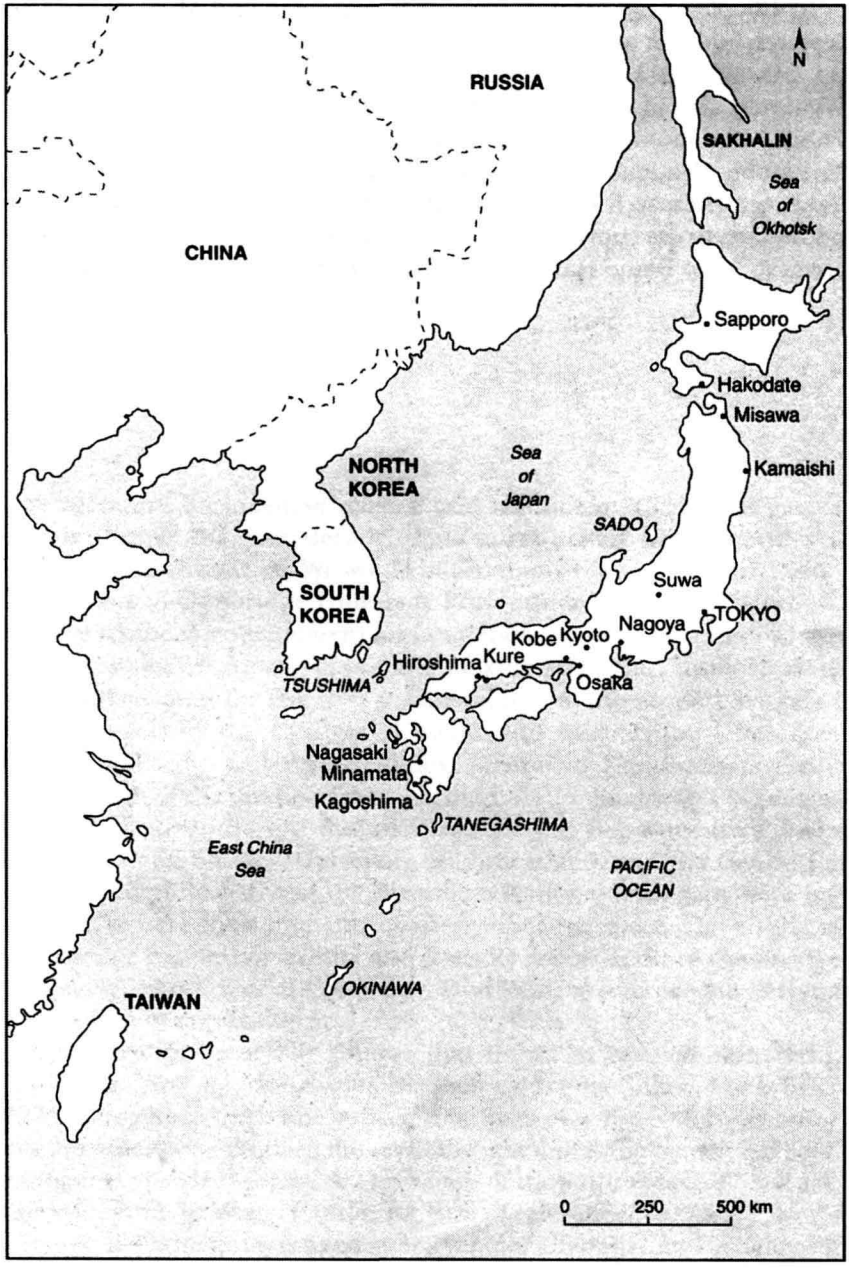

Japan and neighbouring countries

Contents

Introduction

When people think of Japanese science and technology (S&T) a number of images come to mind: Japan as borrower and imitator; Japan and war; Japan as a resource-poor island nation; and Japan's government control. It is generally agreed that these are all important factors in the development of technology in Japan. In studying Japanese S&T the inevitable question arises as to why the Chinese were not able to meet with the same type of success as the Japanese. This is especially puzzling given that the Japanese have borrowed so heavily from Chinese culture in the past. The Japanese, it has been suggested, have exhibited a greater willingness to borrow from other cultures, whereas in China where Confucianism was more rampant, and respect for the past and one's elders more ingrained, the development of S&T was stifled. This is not to say that neo-Confucianist doctrine has not influenced Japanese culture, but the Japanese seem to have reconciled this with their need to learn new ways. Sugimoto & Swain (1978, 1989) have viewed Japan's history as a combination of domestic development and waves of Chinese and Western influence. How one balances the need for indigenous development against the relative ease of foreign borrowing appears to have been a problem throughout Japanese history.

Japan has a long history of borrowing foreign technology, and there has been a military imperative behind it. Samuels (1994, ix) argues that insecurity is the key to understanding what makes Japan tick. The indigenisation of technology, diffusion of it throughout the economy, and efforts to encourage Japanese enterprises which could take advantage of the technology are seen as having been fundamental to national security since the late nineteenth century. The Japan found by Commodore Perry (who headed an American expedition to Japan in the 1850s) had little means to support modern warfare but things changed

with the Meiji Restoration. The slogan 'Rich nation, strong army' illustrates Japan's commitment at the time to create factories that could, among other things, produce modern weapons, with the help of foreigners. Westney (1986, 1987) has described how Japanese military institutions led the way in adopting Western organisational patterns and hiring foreign advisers. The Japanese government played a leading role in the adoption of Western technology with the Engineering Ministry (Kōbushō) spearheading the effort from 1870 to 1885. Large numbers of foreign engineers were brought into Japan during this period. As Japan learnt from the foreigners, they were replaced by Japanese. Private companies gradually took over responsibility for the borrowing of foreign technology, although some important military industries like shipbuilding and railways were either owned or sponsored by the government. The last years of the nineteenth century and the beginning of the twentieth, saw the establishment of associations between large companies such as those between Toshiba and General Electric, Mitsubishi and Westinghouse, and ITT and Nippon Electric. Inter-firm transfers of technology between the United States and Japan have been important ever since.

Military hardware improved during the nineteenth century with the use of railways, the telegraph, and development of weapons. These improvements were not, however, systematic applications of scientific knowledge. It was only in the twentieth century that the connection between scientific knowledge and economic and political power was finally demonstrated, and the concept of science policy was born. It is not surprising that its origins have been of a military nature.

The link between knowledge and power was demonstrated to governments and the military during the First World War. One of the lessons Japan learnt from that war was that nations had to be able to supply themselves during wartime with adequate quantities of raw materials and manufactured goods. Reliance on other countries was seen as a sure way to defeat. Japan's status as a great power was shaken by Germany's defeat in 1918. Germany had far more formidable forces than Japan and yet the country had been vanquished. The Japanese Empire began to be reorganised in a search for self-sufficiency, a search for economic security. In the two decades after the First World War Japan made impressive strides toward a self-sufficient Japanese Empire. Manchuria, for example, had been completely absorbed into it. The Japanese made the mistake, however, of antagonising the West before self-sufficiency was actually achieved. Although Barnhart (1987) has found that army–navy rivalry played a far more important role in propelling Japan into war with the United States, Japan's fundamental war aim was to establish the

Greater East Asian Co-prosperity Sphere as a self-sufficient and powerful unit with the Japanese Empire at its centre.

After the Second World War a strategy was put forward by bureaucrats and administrators in the government which favoured the importation and adaptation of overseas technology. Industries with world market potential were targeted for development. With the outbreak of the Korean War in June 1950, Japan became a supply base for the United States military. As tension mounted between the United States and the Soviet Union, Washington developed a world strategy that included a resumption of military production in Japan in order to rearm the country and to secure a source of military supplies for other Asian nations. Despite resistance on the part of the Japanese and their desire to create a 'rich nation without a strong army', the militaristic aspects of Japanese science and technology and their economy remain.

Peck (1976, 527) pinpoints three distinctive features of Japanese technological development in the postwar period: (1) high returns from importing technology in terms of exports and productivity; (2) extensive government controls over importation of technology; and (3) clever use of management, investment and domestic research and development (R&D) to capitalise on imported technology. From 1952 to 1960 extensive government controls were administered by the Ministry of International Trade and Industry (MITI). The government aimed at making Japan more self-sufficient in materials such as chemicals and iron and steel. Between 1960 and 1965 imports of technology became more oriented toward consumer goods and potential exports, and in the period 1966 to 1972 imports of technology were increasingly those of improvements to technology where the technology had been imported previously. The importation of technology is the most striking feature of postwar Japan, but considerable gains were obtained from Japan's domestic R&D. Japan's economic recovery did not depend on pioneering R&D which led to new products, though the situation is now changing.

Japan is committed to becoming a science and technology-oriented nation. Government expenditure on R&D at time of writing continues to increase. This book explores the relationship between science, technology and society and its contribution to economic growth and the well-being of the Japanese people. The form and content of S&T are governed by class relations/power hierarchies in society, and it will become obvious to the reader that projects which are promoted by the government tend to serve the interests of the dominant groups in society. What will emerge time and again in the chapters that follow is a complex interplay between values, interests, knowledge and power. The world of

science and technology is not very different to that of society. There are strong similarities between scientific practice and other forms of social practice. Furthermore, technology can be viewed as a social system rather than a mere artefact.

Where have readers gone previously to learn more about science, technology and society in contemporary Japan? There are various specialist books and articles in the English language that have appeared over the last two decades (see Bibliography). Shigeru Nakayama's *Science, Technology and Society in Postwar Japan* (1991) is one of the few that provides a sense of the big picture. Nakayama views the development of S&T in Japan in terms of the dynamics of the relationship between the interests of four social sectors: academic, public, private and citizen. The present book builds on the framework of Nakayama's work and suggests that the relationship has grown somewhat fuzzy, with blurring between the divisions. Like Tessa Morris-Suzuki in her important study *The Technological Transformation of Japan* (1994), we are also interested in understanding the process of technological change that these four sectors contribute to. Morris-Suzuki adopts an original approach by emphasising the role of social networks of information in innovation. And like us, she is mindful of the social costs of rapid technological change.

Readers of this book can supplement their reading by referring to a number of useful introductory studies. Takatoshi Ito's *The Japanese Economy* (1992) is an easy-to-understand textbook treatment of its subject. Although a little dated now, and lacking a discussion of the Asian economic crisis of the late 1990s, it provides a solid treatment of economic issues. For an overview of Japanese industry, Tomokazu Ohsono's *Charting Japanese Industry* (1995) provides a handy guide to corporate structure and industrial structure in Japan. And if one's interests specifically concern S&T, any one of the editions of Jon Sigurdson & Alun M. Anderson's *Science and Technology in Japan* (1984, 1991) will provide a good overview of the organisation of S&T in Japan. For a more academic study of issues relating to R&D, readers can turn to Martin Hemmert & Christian Oberländer's *Technology and Innovation in Japan* (1998).

This book presents a synthesis of debates and arguments relating to science, technology and society and the chapters characterise debate surrounding S&T in terms of opposing positions. The reality is that there is often no single answer to a particular problem; this book shows different points of view. What is deemed a success by one group may be viewed as a failure or disaster by another. The structure of the book reflects our attempt to make a balanced investigation of the topic. We deliberately juxtapose competing views to show the diversity of opinions