Reflections on the Current State and Significance of the History of East Asian Technology

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The title of my paper kindly accepted by Prof. Paul Unschuld in his capacity as organizer of the 11th Conference of the International Society for the History of Science, Medicine and Technology in East Asia1 might imply that the state and significance of East Asian history of technology as an academic field will be presented here in its entirety. Everybody who has experienced the many-faceted richness of the subject will agree that a few reservations with regard to the title should be made. The first reservation concerns historical periods. Here, the subject of the history of technology is generally confined to the pre-Second World War epochs; contemporary technology is not included. Secondly, the research data provide evidence of a clear preponderance of studies on the history of Chinese technology. This fact is not only borne out by the scholarly tradition still prevailing in the field, but is also corroborated by my own findings when asking colleagues in Japan and Korea about the present research situation.2 Likewise it is reflected by the papers presented at our conference. Although nationally and internationally co-ordinated, interdisciplinary large-scale research activities with-

1 The conference took place from August 15 to 20, 2005, at the Deutsches Museum, Munich. The paper was given as opening lecture in the Ehrensaal of the Deutsches Museum on August 15, 2005.

2 Here I would like to thank Prof. Yung Sik Kim, Prof. Horio Hisashi, Prof. Tanaka Tan, Prof. Watabe Takeshi, and Dr. Ataru Sotomura for their kind help.
in the field of the history of technology are not as numerous as in neighbouring academic fields; there are, however, a good number of research works by individual scholars to hand. A few of them are presented here. Moreover, by paying special attention to the most recent European contributions to the field, I would like to express our feelings of high esteem for the historic venue of the Deutsches Museum where our conference is taking place and our gratitude for the kind hospitality of Prof. Dr. Wolfgang Hackl, Director General of the Deutsches Museum.

Let me start by introducing the agenda of my paper. After a few sentences on the general understanding of technology and in particular the academic field of the history of technology, followed by a short note on the historical importance of the three (or possibly four) great Chinese inventions (四大发明) for the history of mankind and of technology, I shall present a selection of statistical data on publication activities before talking about a small number of significant research projects available in publications and manuscripts. Finally I will address a shortcoming and a prospect closely linked to the professional training of historians of technology of East Asia. I shall not, however, explore the numerous internet platforms and databases, projects concentrating on teaching the history of technology, or go into present and future research projects which are known from announcements only.

What is the Academic Field of the History of Technology About?

The history of East Asian technology appears to be a clear-cut topic. Nonetheless, while we all have a certain understanding of the concept of technology, still—in the words of Kranzberg and Purcell—“the term technology cannot be defined with precision.” This applies to the Western term “technology” as well as to the Chinese jishu 技术 and gongyixue 工艺学 and the Japanese gijutsu 技术 and kōgeigaku 工艺学. Technology in its historical context is much more than artefacts and tools, machines and processes, the products of the human intellect and imagination—the fundamental units central for the study of technology and its history. Technology is also the framework of the ordinary activities of human beings; it deals with man’s attempts to satisfy his wants by human action upon physical objects and with the production of commodities, and it is also

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3 A reader could draw a completely different conclusion when tracing the discussions on technologia, technology, technologie, Technologie etc. which have taken place in the twentieth century. See the 600 titles collected in Jacques Guillerme, Jan Sebastik, “Les commencements de la technologie,” Thales 12 (1986), pp. 1-72; see also Francois Sigaut, “More (and enough) on Technology,” History and Technology 2 (1985), pp. 115-132.

capable of creating elaborate structures and devices, as we know so well from pre-modern East Asia.\(^5\) Thus technology in the context of pre-twentieth century history is neither another name for applied science, nor its handmaiden, nor an understanding of “technics based on science” as Cardwell\(^6\) and other authors concentrating on contemporary technology would like to convince us of; nor is it necessarily, as Galbraith stresses, “the systematic application of scientific or other knowledge to practical tasks.”\(^7\) Science and technology have to be distinguished. Francois Sigaut described the interrelation between science and technology as follows:

Science has always used techniques, and always will. Yet it will never aim at something other than knowledge, or it will cease to be science. Technique has always used whatever knowledge could be found (including scientific knowledge, inasmuch as it was available and relevant). But it simply cannot aim at something other than the production of material goods and services, or it is not technique any more.\(^8\)

For pre-modern history it is man the maker, *homo faber*, who masters techniques and has the capacity to produce artefacts of all sorts.\(^9\) His expert craftsmanship, as old as humankind, did not draw upon theoretical knowledge.\(^10\) In the words of A. R. Hall: “Literacy and learning has little to do with technology.”\(^11\) And so I am still inclined to prefer the descriptive definition of R. A. Buchanan over all the others that “the history of technology is about people, and the way in which

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\(^10\) George Basalla (1993), pp. 27-30: “The artifact—not scientific knowledge, nor the technical community, nor social and economic factors—is central to technology and technological change.”

people have made and done things, and the implications of these actions upon each other.”

**Recollecting the Four Great Chinese Inventions in World History**

The great feats of mankind prior to the sixteenth century which changed the parameters of the Western world were based on, or at least inseparably linked to, various technological inventions or discoveries of Chinese origin. At the dawn of the scientific age Francis Bacon (1561-1626) reflected on their importance for mankind at large. In 1620 he stated in his *Novum organum* [New Instruments (of Reasoning)] that

> […] the arts of printing, gunpowder and the compass […] have changed the whole face and condition of things throughout the world, in literature, in warfare and in navigation. From them innumerable changes followed, so much so, that no empire, no sect, no star has been seen to exert more power and influence over the affairs of men than have these mechanical discoveries.

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When Francis Bacon wrote about the arts of printing, gunpowder, the compass, about paper, silk, and sugar, all these imports were no longer novelties.

14 Just recently Cao Zhi 曹之 argued in his book Zhongguo yinshuashu de qiyuan 中國印刷術的起源 (The Origins of Chinese Printing), (Wuhan: Wuhan daxue chubanshe, 1994), that block printing (diaoban yinshua 雕版印刷) originated in China at the beginning of the Tang dynasty. See also Luo Deyun 羅德運 “Jiekai Zhongguo yinshuashu de qiyuan zhi mi: jianping Zhongguo yinshua shu de qiyuan” 揭開中國印刷術的起源之謎: 鏡平中國印刷術的起源 (Revealing the Secret of the Origins of Printing in China: A Review of Zhongguo yinshuashu de qiyuan), Zhongnan minzu xueyuan xuebao (Journal of South-Central University for Nationalities) 5 (1996), pp. 63-66. Pan Jixing published a paper in which he strongly advocates that the origin of printing originated in China not later than the Daye 大業 reign-period (605-618) of emperor Yangdi of the Sui dynasty. See Pan Jixing 潘吉星, “Yinshuashu de qiyuandi: Hanguo haishi Zhongguo” 印刷術的起源地: 韓國還是中國 (The Birthplace of Printing: Korea or China), Ziran kexue shi yanjiu (Studies in the History of Natural Sciences) 1 (1997), pp. 50-68. As far as the origin of movable metal-type printing is concerned, Pan Jixing holds the opinion that the technology travelled from China to Mainz. He incorporates the research results by Western historians such as Dr. Eva Hanebutt-Benz, Prof. Dr. Wolfgang von Strömer and Dr. Henri-Jean Martin, who argue that thirteenth and fourteenth century travellers brought the technical information of movable type from Yuan China to Europe. See Pan Jixing, “Cong Yuan Dadu dao Meiyincai—Gutengbao jishu huodong de Zhongguo beijing” 从元大都到美因茨—谷滕堡技術活動的中國背景 (From Khanbalig to Mainz—the Chinese Background of Johann Gutenberg’s Technical Activities), Zhongguo keji shiliao (China Historical Materials of Science and Technology) 19:3 (1998), pp. 21-30.

15 The earliest western references to gunpowder based on Arabic sources can be found in De mirabili potestate artis et naturae (About the Wonderful Powers of Art and Nature) of 1242 by the Franciscan Roger Bacon (1219-1292) and in the manuscript Opus de mirabilibus mundi (Work on the Wonders of the World) of 1265 by the Dominican Albertus Magnus (1200-1280). In 1402 Konrad Keyser (born in 1366 in Eichstätt) finished his work Bellifortis (The Warstrong), an illustrated manuscript on the making of gunpowder and the production and technology of fire-weapons. The manuscript was intended to help rulers of his time to maintain their political power. See Rainer Leng, Anleitung Schießpulver zu bereiten, Büchsen zu laden und zu beschießen. Eine kriegstechnische Bilderhandschrift im CGM 600 der Bayerischen Staatsbibliothek München, Department of Medieval History, University of Würzburg, unpublished manuscript 1993; see also the short introduction by Ulrich Montag, “Der ‘Belliforties’ des Konrad Keyser aus Eichstätt,” Aviso. Zeitschrift für Wissenschaft und Kunst in Bayern 4 (2000), pp. 8-9.

16 Already in 1190 Alexander Neckam (d. 1217), an English monk who had studied at Paris, described in his De naturis rerum (On the Nature of Things) the advantage of a magnetic needle for sailors, i.e. a mariner’s compass. See Joseph Needham, Science and Civilisation in China, Vol. IV:1, Physics, Cambridge: Cambridge Univ. Press, 1962, p. 246, who quotes from the translation by C. E. N. Bromhead. As far as the origin of the compass is concerned the south-pointing property stressed in Chinese textual sources may be of importance—most of the Arabic accounts demonstrate the south-pointing property of the lodestone or needle. Furthermore the Persian and Turkish names for the instrument
but well established in many parts of the Old World.\textsuperscript{17} The medieval authors Roger Bacon (1219-1292), Albertus Magnus (1200-1280), Alexander Neckam (d. 1217) and others who had written about the three inventions as representatives of medieval scholasticism were fascinated by the specific quality of “the wonderful powers of art and nature” but did not comprehend their overruling quality of being something new. The adjective “new” in the title of publications became popular several hundred years later when the New Philosophy “presented a revolutionary conception of the world”\textsuperscript{18} which can be documented in all fields of science and technology,\textsuperscript{19} at a time when, in the words of Lynn Thorndike,
“the new was very much in the consciousness of the men of the seventeenth century.”

Let me return here to the “three inventions” emphasized by Roger Bacon. To my knowledge there is no other field in the history of East Asian technology which in the twentieth century attracted more attention and a greater amount of research effort than the subjects of printing, paper-making, gunpowder and the compass. Just recently in 2002 Pan Jixing 潘吉星 documented in his splendid publication Zhongguo gudai sida faming 中國古代四大發明 (The Four Great Inventions of China) the overall importance of the three “mechanical discoveries” as Bacon called them. Iwo Amelung of the University of Tübingen, formerly involved in Michael Lackner’s project on “Exchanges of Knowledge between China and the West” at the University of Erlangen, comments on the “four inventions” in his paper presented here at the conference.

Francis Bacon addressed the sociological and historical impact of discoveries, the historical turning point in the history of technology which formed the basis for the emergence of new parameters in Western society, while Jerome Cardan (1501-1576) in his De Subtilitate (On Subtlety) of 1550 tackled the problem of placing inventions in an historical context by trying to identify inventors and their inventions. In his opinion the magnetic compass, printing and gunpowder are inventions to which “the whole of antiquity has nothing equal to show.” While he placed technological inventions in an historical context, “it was not until the seventeenth century,” as Lynn White Jr. already observed, “that Jesuit missionaries to the Orient persuaded Europeans to believe that several of the fundamental inventions which are alleged to have made the modern world modern were of Chinese origin.”

21 Published by Zhongguo kexue jishu daxue chubanshe in Hefeiishi.
23 Jerome Cardan was not the first to do so. Before him Polydore Vergil had already tried to identify inventors and their inventions in his De Inventoribus Rerum (On the Inventions of Things) of 1499 including gunpowder, printing, silk, metal, wire, glass, and ships.
A Selection of Comparative Statistical Data on Publication Activities Concerning the History of Technology

Let me continue by trying to gauge the state and significance of the history of East Asian technology at the present aside from the three (or four) inventions so powerful and influential on the course of human history. All of us here share an idea of the importance of the history of the science, medicine and technology of East Asia. In analogy to Wu Guosheng’s recent article “Kexue shi de yiyi” 科學史的意義 (The Significance of the History of Science), I could idealistically claim that the significance or use of the history of technology should be to serve technology itself, to enhance the quality of knowledge about technology in education, and that it should be part of learning for the sake of learning. Such a philosophical approach, as may still be justified for the classical fields of the history of science, would be, in my opinion, too idealistic for the history of technology as an academic discipline. This is especially so when one considers that outside China research in the history of East Asian technology has shifted away from the original fields in the history of technology to the exploration of technological impacts, for example Michel Foucault’s “technologies of power”, Pierre Bourdieu’s “concept of habitus” and the construction of social fabrics, Francesca Bray’s conception of technology as a constituent of the fabrics of power in history, or technology as knowledge applied in the field of social engineering. In China the broadening and redefining of the application of technological methodologies and the posing of—from a conservative Chinese point of view—“unconventional” questions in historical research was not taken up or actively promoted. To be sure, in recent years a great number of publications on traditional crafts have been published. But despite tremendous publication efforts the comparatively weak academic position of research on the history of technology has not gone unnoticed in China.

In support of this critical view let us have a look at a few statistical data and the publication activities in history of East Asian technology in comparison to the history of science and medicine. A bibliography published in Zhongguo keji

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29 Francesca Bray, Technology and Gender, Berkeley: Univ. of California Press, 1997, p. 2.

Dieter Kuhn: Significance of History of East Asian Technology

Significant Research Projects Available in Publications and Manuscripts

With regard to monographs on the history of technology a good number of profound and long-awaited publications have appeared in China. The most impressive publication of recent years is the thirty-volume series Zhongguo kexue jishu shi 中國科學技術史 (History of Chinese Science and Technology) started in 1996.31 Twelve volumes dedicated to technological matters cover architecture, mining, textile technology, paper and printing, military technology, transport and the traffic system, irrigation and hydro-technology, mechanics and machinery. It is hardly a coincidence that the title of the series is identical with the Chinese title of Joseph Needham’s Science and Civilisation in China (Zhongguo kexue jishu shi) quoted in the preface of the series. Eight volumes of another highly promising series entitled Zhongguo chuantong gongyi quanji 中國傳統工藝全集

31 Published by Kexue chubanshe in Beijing.
(A Complete Collection of Chinese Traditional Technology) are about to be published in September 2005. The volumes comprise the fields of lacquer, gold and silver, porcelain and ceramic, gunpowder, paper making, sculpture and silk weaving and dyeing technologies and handicrafts. Six more volumes will be released by press in early 2006. The other publication to be mentioned here is the series Zhongguo gudai gongcheng jishi daxi 中國古代工程技術史大系 (Complete Works of the History of China’s Ancient Engineering Technology) in 20 volumes announced for many years but not yet released from press. The contents of the Complete Works concentrate firstly on the development of engineering technology (gongcheng jishu de fazhan 工程技術的發展) from earliest times (yuangu 遠古) until 1840, secondly on the relation of technology and society (jishu yu shehui de guanxi 技術與社會的關係), and thirdly on traditional technology (chuantong jishu 傳統技術) after 1840.

When browsing through the various volumes of the thirty-volume series of the History of Chinese Science and Technology it doesn’t escape the reader’s attention that most of the volumes available are arranged in accordance with the Chinese understanding of the history of technology. The way in which many of the quotations from the Chinese sources are presented and illustrations are added convey the impression that the texts and the figures always perfectly complement each other. In the traditional understanding, already documented from Song times, technical images cannot be studied independently of the texts with which they were paired (or from which they were constructed). Francesca Bray, Georges Metaillé and others give evidence in their forthcoming volume Graphics and Text in the Production of Technical Knowledge in China that from the “Chinese perspective tu was not a stylistic but a functional category: tu were instructive images, conveying skilled, specialist knowledge.” All historians of technology concede that it needs specialised knowledge to read technical images.

Our Chinese colleagues have made an admirable and unparalleled publication effort with their History of Science and Technology in China providing us with an excellent insight into the present state and significance of Chinese history of technology as viewed and advocated according to a methodological understanding rooted in Chinese tradition. In the programmatic wording of the chief editor Lu Jiaxi 卢嘉锡, “Chinese science and technology of ancient times constitutes the rich heritage handed down from our forefathers to us.” Thus the idea of the thirty-volume History was not to discuss the methodology of past and present research, not to mention Western methodology or research results, and it neither

32 Edited by Lu Yongxiang 路甬祥, published by Daxiang chubanshe in Zhengzhou.
34 Edited by Lu Yongxiang 路甬祥 of the Chinese Academy of Sciences and published by the Shanxi jiaoyu chubanshe.
reflects the scholarly discourse (going on in the outside world) nor distinguishes the main stream and the tributary developments within the field. Or to put it in the words of Hua Jueming 華覺明: “Generally speaking, at present the research into the history of science and technology in China still centres on the inner history, and compared with advanced countries we still have a long way to go in respect to fundamental construction of the fields of learning.” The intention of the editors appears to be to provide a sort of survey of technological knowledge which is viewed as being of fundamental and lasting value regardless of future investigations and their results. Publication policy as manifested in the volumes available allows the conclusion that each of the subjects is treated as if all were of equal historical significance and present relevance, as may be seen in the volumes on jixie 機械 (mechanics and machinery), fangzhi 纖織 (spinning and weaving), and shuili 水利 (irrigation and hydro-technology). The long-established principle of equating the various fields of technology and putting them on a par is an egalitarian creation. In reality, the importance of a certain technology for a society and thus the history of technology depends on the resulting impact. Not all technologies, according to Francis Bacon, “have changed the whole face and condition of things throughout the world”, or, to put it in our own words, have changed the parameters in history. Several factors apart from the technological ones had to come together in a society to accomplish such a “revolutionary” feat. Many of the originally Chinese technologies appeared in Europe at the right time and place to change “things throughout the world” but did not have a revolutionary effect on Chinese society. Thus a change of technological parameters in technology did not necessarily result in a transformation of society as we know from Chinese history. The Chinese editors are well aware of this fact and so they decided that “in view of the fact that the study of ideas and concepts of technologies has been a weaker area,” as Hua Jueming conceded, “the Complete Works [should] include a special volume on ‘Ideas and Concepts of Technology’.”

36 Ibid.
38 Edited by Zhao Chengze 趙承澤, 2002.
40 Printing, paper making, gunpowder, and the compass have changed “the condition of things throughout the world”, but these technological achievements did not have the same sort of effect in China. From the field of textile technology several examples can be put forward giving evidence of a change of technological parameters, such as the invention of various types of treadle-operated looms, which as far as we can tell did not trigger off in China such revolutionary changes of production as well as the transformation of textile commerce as happened in Europe in the fourteenth century.
A critical history of pre-modern Chinese and East Asian technology which allows greater regional and temporal differentiation, distinguishes between the advanced performers and the backwater craftsmen, and identifies the role which the “organic body”—i.e. local environment and traditions—plays in a society, to mention only three technology-innate topics, still remains to be conceived and written. However, this is not to say that no excellent individual historical research has been done and published in several specific fields of technology in China and elsewhere. As an informative and recent example I could mention the project on the history of Chinese surveying and mapping of heaven and earth (Zhongguo cehui shi 中国测绘史) initiated in 1989, encouraged by Song Jian 宋健, member of the State Council and director of the China State Science and Technology Commission, in 1993 and published in 2002 in three volumes covering technological and institutional history from the beginning until 1989.\(^{42}\) I would very much welcome a fourth volume documenting the serious and drastic topographical transformations of the Chinese landscape as witnessed for example in several provinces over the past thirty years, turning farmland, orchards, bamboo groves and valleys into residential suburbs, industrial areas and technology parks, and levelling hills and small mountains by exploiting them as quarries effecting far-reaching and incalculable changes of the “organic body” of many regions with long-term consequences.

In the sense of technological research into the “organic body” of a society a remarkable and far-reaching international and multidisciplinary five-year French-Chinese research project on Water Control and Social Organisation, particularly in the Jingshui 涞水 and Weihe 渭河 River valleys of Shaanxi province and the Fenhe 汾河 River valley of Shanxi province, was started in 1995. Two institutions conducted the project: the École Francaise d’Extrême Orient (Faguo yuan-dong xueyuan 法國遠東學院) and Beijing Normal University (Beijing shifan daxue 北京師範大學).\(^{43}\) Many other French and Chinese institutions and universities joined in over the years. The four volumes published in 2003 edited


by Christian Lamouroux (École des Hautes Études en Sciences Sociales), Dong Xiaoping (Beijing shifan daxue) and many others explore and investigate archaeological finds and the problems of water control, management, and distribution in pre-modern times and in the twentieth century, plus the social and religious background to these. They provide evidence of the belief system that "the life of the people depended on Heaven (kaotian 靠天)." Volume three is exclusively dedicated to the relevant epigraphic documents from Shanxi province covering the time period from 1139 until 1909. The results of the research project were presented at a three-day conference “Hydraulic et société en Chine du Nord” held in Paris in June 2004.

Touching on the question of the societal and economic background of technology I would like to mention here the volumes on Mining by Peter J. Golas (1999), and on Ceramic Technology by Rose Kerr and Nigel Wood (2004), recently published in Joseph Needham’s Science and Civilization in China series and innovatively seen through the press by Christopher Cullen. Ceramic Technology will certainly become the standard reference work.

In March 2003 Hans Ulrich Vogel and Christine Moll-Murata held an international workshop on “Chinese Handicraft Regulations of the Qing Dynasty: Theory and Application” at the University of Tübingen. It formed a part of the research project “State and Crafts in Peking, 1700 to 1900”. Happily, the workshop papers appeared in print just a few months ago. The jiangzuo zeli 作則例 (handicraft regulations and precedents) as investigated and presented here not only comprise the “rules and data concerning techniques, materials, and funds for the construction and production of utility goods,” but are also understood as “a product of the administrative process of the imperial bureaucracy.” Thus the “handicraft regulations and precedents” offer a bureaucratic perspective on the management and administration of projects, mainly of public concern. The relevant official compilations provide information on the relationship between officials in charge of projects and the respective contractors and agents, the production or construction processes, inventory lists, goods, and building materials, the regulation of market prices and wages, and many more topics. In this context of handicraft administration and organisation I would like to mention a research project on the “Organisation and Technology of Silk Workshops in the Ming and early Qing Dynasties” conducted between 1994 and 1997 at the University of Würzburg. Among other works a survey on the organisation of central and

regional state-owned silk workshops and the various production categories was published under the title *Weaving an Economic Pattern in Ming Times (1368-1644)* in 2002.47

### Technology in a Historical System of Knowledge

But there are also other fields which deserve attention, for example, the joint research project “Development of Mechanical Knowledge in China” conducted by the Partner Group of the Max Planck Institute for the History of Science at Berlin and the Institute of the History of Natural Sciences of the Chinese Academy of Sciences. Here, William G. Boltz, Jürgen Renn and Matthias Schremmel have published *Mechanics in the Mohist Canon and Its European Counterpart: Texts and Contexts* as a PDF file, and aside from the project Prof. Zhang Baichun, who acts as head of the Partner Group, has made a number of essential contributions to the field of mechanical engineering.

In the context of the historical processes of structural change in systems of knowledge it may be of interest to mention here another attempt to make technology in a system of knowledge visible. It was undertaken by Dagmar Schäfer of the University of Würzburg. She attempted to redefine the place of the *Tiangong kaiwu 天工開物 (The Works of Heaven and the Inception of Things)* in the intellectual and scientific community of the seventeenth century by investigating the biography of Song Yingxing 宋應星 as well as his other major publications. On the basis of her findings she challenges the traditional and still prevailing view of reading and interpreting the *Tiangong kaiwu* as an encyclopaedia of technology and science exclusively. In her opinion the *Tiangong kaiwu* has to be considered in a cosmological context, which actually asks for a reinterpretation of the well-known mono-causal and, compared to her reading, almost simplistic evaluation of the purely technological context of the work. A number of renowned scholars support her exemplary approach. In my opinion much more contextual and analytical but at the same time provocative research is necessary to establish a better and more reliable structure for answering the crucial question of how technology fits into Chinese history and what role it played in private and public daily life in various periods of pre-modern Chinese history.

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48 Investigated by Prof. Jürgen Renn of the Max Planck Institute, Berlin.
Everyday Technologies in the History of Technology

Finally, let me leave the research subject of technology as presented, described and illustrated in ancient books, and let me draw your attention to research in the history of technology based on the investigation of everyday technologies, which has outstanding and exemplary forerunners in Rudolf P. Hommel’s China at Work, originally published in 1937, and in Tan Danjiong’s Zhonghua minjian gongyi tushuo. Here is not the place and time to list the many Chinese, Japanese, and Korean ethnology-based research studies on contemporary rural technology published in recent years. Nonetheless, I’m confident that the spirit and methodology of China at work will re-emerge in the history of technology, including agricultural technology. In her Volkswagen-financed research project on History and Ethnology of Chinese Everyday Technology established in 2002 at the TU Berlin, Mareile Flitsch and her team have started to ask many technology-related questions along the lines of an anthropology of technology. Watabe Takeshi, Huo Wei, and Christian Daniels provide an expert example in their recently published book Shisen no dentō bunka to sei-katsu gijutsu on traditional culture and everyday technologies and how they work at present in Sichuan province. They describe and picture a wide range of topics such as building and housing, bridges, farming, ploughing, and fishing, tools and gadgets, baskets and wickerwork, to mention only a few. And as far as solid comparative technological studies from the field of material culture are concerned—of which only a lamentably small number exist—there are still the publications of Yoshimoto Shinobu on the classification of handlooms, which should be mentioned as exemplary.

In this paper I have so far tried to reflect the state in which mainstream research into the history of East Asian, and especially Chinese, technology finds itself at present. The current state as presented here is based on available publications and manuscripts, the only publicly accessible, and thus reliable and trustworthy source for an appropriate evaluation.

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Let me now raise a final, most difficult and provocative, issue in this talk, one which I would like to sketch in rough outline. Unlike historians of science, who as a rule receive a university education in a field of science and thus are professionally qualified in such a way that they are or should be able to earn their living not only inside but also outside academia, historians of technology specialising in East Asia are mostly exclusively academically educated scholars who have not learned a trade or craft from scratch for several years (if at all). All they know about technology and working techniques, including the indispensable information required and the methodology necessary, they are taught in theory in a classroom. In some cases they also gather practical knowledge through fieldwork projects or other means. To put it another way, as a rule historians of technology are primarily historians, not practitioners. In some cases they are engineers, but these very often lack the indispensable dimension of an academic education as historians. In the history of technology questions are frequently asked simply for their own sake. But mostly they do not lead to any presentable answers or substantial results which can be used to benefit scholarly discourse. There is the technology-immanent difficulty or even problem of asking relevant and at the same time answerable questions leading to clear answers that can be used for the positioning of a technological problem in a wider historical context. I do not intend to discuss the pros and cons of the problem, but, speaking from my own experience, I believe that it cannot be separated from an individual historian’s perception of the practitioners’ world. Historians, including historians of technology, normally lack the experience of years of drill and work at a defined workplace in a workshop or elsewhere where technical skills and working conditions define income, status and thus the conditions of life. Work should be viewed as the common denominator of pre-modern technology. The various types of place where work is done, where products are made, are the locations where techniques mastered by craftsmen and technology—as evident in the products of craftsmanship—and the human sphere of craftsmen and artisans, material and men, mesh together forming an inseparable working unit. Here the understanding of the work which has to be done and thus the work ethic involved does not derive from books and theoretical teaching, but from experience with the materials, and sometimes from oral tradition handed down for generations. It is these that create the basis for the prevailing attitude towards work, and its processes and pressures. This attitude towards work is physically felt—the atmosphere and smell emanating from the physical work and the materials pervade the place at all times. As different materials in various stages of manufacture are identifiable by touch, so workshops are identifiable by smell. Practical experience gained over years is not only essential but indispensable for evaluating the mode of the human input (under the conditions given) into everyday technology and thus the production of goods. Such an experience cannot be made up for by three weeks or three months practical training of various kinds. The instructive interviews with the
traditional handloom weavers of Kyôto, the Nishijin 西陣 craftspeople featured in Tamara K. Hareven’s *The Silk Weavers of Kyoto* of 2002, strongly support this assessment of the necessity of finding ways to document workshop realities in a more down to earth way.53

In conclusion I may say that with regard to academic education and professional training the historians of technology find themselves in a rather difficult position compared with historians of science. Hence the specific educational situation, which in my opinion cannot easily be altered or reformed, has to be taken into consideration as a fundamental factor when evaluating the outcome of research in the field of history of technology. And here we have to concede and acknowledge once more that historians of technology are first and foremost historians.

**Concluding Proposals**

After the many excursions into the theory of the history of technology that we have all witnessed in recent decades, I strongly advocate returning to the roots of the topic. There is still a lot to be done. In the past technology and the mastering of techniques—which as we all know can never be adequately accounted for by a verbal description,—formed the most significant and unmistakable part of the world of the practitioners. We, in our capacity as historians of technology, should always be aware of this characteristic and distinctive feature, one that in the end makes all the difference from the work done by historians involved in research in other fields of history.

I would welcome renewed attention being paid to the following:

- tools and machinery of different makes in publications and fieldwork,
- the mastering of technical skills and regional varieties within the framework of the “organic body”, the local environment and traditions,
- regional and temporal differentiations of products in quality and quantity,
- the characterization of differences between production techniques and products at the centre and at the periphery,
- philological problems of historical technological terminology.

The search for and explanation of the practitioner’s world, his craftsmanship, actions and products in the context of history, constitute the collective particularity of the subject historians of technology are dealing with. This collective particularity of the history of technology underlines its relevance for the understand-

ing of historical development in general, and also helps to explain how East Asian civilizations became what they were and are thought to have been in the technological network of the pre-modern societies of the Old World.