

Reorganization of Science and Technology in Occupied Japan

- Conformity to the Global Standard -

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The United States, administered by Harry S. Truman, played a central role in Occupied Japan. General Headquarters (GHQ) of the Supreme Commander for the Allied Powers (SCAP) considered Japan necessary to reorganize science and technology for accomplishment of its objectives, which included economic reconstruction as stipulated in SCAPIN 47 issued on September 22, 1945, democratization and non-militarization as directed in SCAPIN 1 issued on September 2, 1945, and SCAPIN 2 issued on September 3, 1945. The United States expected Japan to become its supply base for the rest of Asia after returning to the global capitalist system at that time. This paper aims to specify the reorganization of Japan's science and technology by GHQ, including the perspective of public health quality control for transforming Japan into a supply base that conformed to global standards for the world, not just for the United States.

占領期日本において、トルーマン政権のアメリカは中心的役割を果たした。連合国軍最高司令官総司令部（GHQ/SCAP）は日本経済が復興し、民主化と非軍事化を進めるには日本の科学技術の再編が必要であると、1945年9月22日発行の日本政府への対日指令(SCAPIN)-47、1945年9月1日発行のSCAPIN-1、1945年9月3日発行のSCAPIN-2で明記している。さらにアメリカは日本がアジアの供給基地となることを期待した。本稿の目的は、日本がアメリカだけではなく世界にとってもグローバルスタンダードに則った供給基地になるために、日本の科学技術の再編が公衆衛生の視座を含めて実施されたと明示することである。

Keywords : Occupied Japan (占領期), economic reconstruction (経済復興), democratization and non-militarization (民主化、非軍事化), global standard (グローバルスタンダード)

1. Introduction

The purpose of this paper is to consider the reorganization of Japan's science and technology by GHQ, including the perspective of public health quality control for transforming Japan into a supply base that conformed to global standards for the world, not just for the United States.

The U.S. government under Truman played a crucial role as a reformer and decision-maker of Japan's political, economic, and social structures after World War II. General Headquarters (GHQ) of the Supreme Commander for the Allied Powers (SCAP) considered it necessary to reorganize Japan's science and technology for accomplishing its objectives. The goals included Japan's democratization, non-militarization, and economic reconstruction, as directed in SCAPINs issued in September 1945. Through these reforms of Japan's political, economic, social, and military structures, the U.S. government expected Japan to be its supply base in Asia after its return to the global capitalist system. The United

States had to prevent the Union of Soviet Socialist Republics (USSR) and China from expanding communism and socialism, especially in the later period of the occupation of Japan. The United States needed to prepare for the Cold War.¹

To make Japan become a supply base, not only for the United States but also for the world, the poor quality of manufactured products made in Japan was a primary issue that Japan had to solve. SCAP was responsible for reorganizing sciences and technologies in postwar Japan and requested the first Scientific Advisory Group that the National Academy of Sciences (NAS) in the United States sent to visit the country to evaluate the democratization of scientific research there.

This Scientific Advisory Group was an industry-academia collaboration group consisting of university professors, directors of a botanical garden and a food research institute, and executives of an electric company. They were experts in the fields of chemistry, electrical engineering, food, and botany. The second Scientific Advisory Group visited

Japan in 1948, consisting of professors and executives of companies led by Dr. Roger Adams, Head of the Department of Chemistry, the University of Illinois at Urbana-Champaign.

The second Group recommended six actions, including the establishment of a nationwide scientific organization, financial support for foreign language education for senior students, the promotion of exchange programs of senior scholars between Japan and other countries, the improvement of scientific research institutions with profits from the export, the foundation of a few advanced scientific research and education centers, and the increase of scientists' knowledge and capabilities to solve actual problems of industries, agriculture, and public health. Following the recommendations of the second Advisory Group sent by NAS in the United States, the Economic and Scientific Section (ESS) led by Chief, William Frederic Marquat, which was engaged in activities related to economic and scientific issues in Japan, further promoted the reorganization of Japan's science and technology.

The Second Advisory Group had two purposes that the Group supported the reorganization plan of Japanese science and technology, and the Group gave the prestige to establish the Nihon Gakujutsu Kaigi (Science Council of Japan). The shift of America's occupation policy in 1949 influenced the ESS's efforts. Namely, the Dodge Line aimed to let Japan be independent and become a supply base of the United States in East Asia. The United States reduced the amount of money it used for Japanese people following the recommendation about the usage of the budget by Joseph M. Dodge, Financial Adviser to SCAP.²

The ESS tried to enlighten quality control among government officials and private companies in Japan. To achieve this objective, the ESS invited quality experts from the United States to Japan. At that time, quality improvement conflicted with manufacturing large volumes of products at a low cost. It was the common idea that making goods of high quality was expensive. Most of ESS's efforts to improve the quality of Japanese products were not successful until 1950. The critical reason for the failure of quality improvement of Japanese goods was that most people thought producing high-quality goods took high costs. Thus, the government and industries in Japan were reluctant to tackle the problem of quality improvement.

In the form that corresponded to the necessity to find an efficient way of quality improvement of Japanese scientists

and engineers, the Research and Program Division of ESS requested Deming to instruct statistical quality control (SQC) to the Japanese manufacturing industry. The Union of Japanese Scientists and Engineers (JUSE) also invited Deming and asked him to give lectures in 1950 in Tokyo, Nagoya, Osaka, and Fukuoka. Deming held SQC seminars only for executives in Japanese companies in Hakone in July 1950. Many previous scholars have emphasized Deming's contribution, claiming that Japan achieved miraculous economic recovery thanks to his teachings about quality control.³

2. Science and technology in occupied Japan

(1) Need to Reorganize Science and Technology

GHQ/SCAP considered reorganizing science "as a powerful social force." Atomic bomb development during World War II globally promoted the intention of effective science and technology at the national level. SCAP was responsible for Japan "could be accepted back into the family of nations without undue fear of her re-emergence as an aggressive power." SCAP simultaneously thought that strong science and technology were required for Japan's economic recovery since they were the basis of a sound modern economy when there would be great changes in "methods, markets, and sources of raw materials" in Japan. Additionally, SCAP felt that science and technology constituted a war resource, and appropriate balance should achieve. Further, SCAP recommended they should be properly and democratically controlled by people through the governmental systems and scientists who belonged to science organizations established and controlled democratically.

SCAP understood that the Japanese government officials who were not fully familiar with science and technology controlled all measures on them. Such government officials who hardly knew science and technology operated laboratories. The Ministry of Education was dominantly in charge of governmental science administration. It played a role in distributing a bulk of government funds to research works of the National Research Council and the Imperial Academy. The above organizations were under the control of the Ministry of Education. As stated in the above, science and technology were fundamental for the people, SCAP considered that dominant control of science and technology by the Ministry of Education was out of the age when other ministries were able

to have the responsibility of science and technology including public health, industry, agriculture, and mining.

GHQ/SCAP supported Japanese scientists to establish the first organization for the scientists called the Kagakushogai Renrakukai (Japanese Association for Science Liaison: JASL) for the field of engineering in December 1945, for the field of agriculture and fishery in February 1947 and the field of medicine in March 1947. JASL needed to conduct the activities, including providing closer contact between GHQ/SCAP and Japanese scientists, a reliable flow of information about Japanese scientists to GHQ/SCAP. These convenient centers collected scientific questions on the occupation and making some determination to find the solution of technical problems bearing on economic reconstruction.⁴

JASL's central office had a liaison with the Ministry of Education, and its regional offices had a relation with the Imperial Universities. Namely, Tokyo University oversaw Hokkaido, Tohoku, and Kanto districts, Nagoya University oversaw the district of Tokai, Kyoto University and Osaka University oversaw the Kansai district, and Kyushu University oversaw the Kyushu district. SCAP did not intend to remove old organizations, but they wanted to know from groups of scientists about the best organization to work out in Japan. SCAP expected JASL to be an independent liaison group between the established groups and others to be formed. JASL accepted to be responsible for advising about the reorganization of the national bodies which were engaged in science and made an effort to collect desirable actions from the traditional bodies including the Gakujutsu Kenkyu Kaigi (National Research Council: NRC), Teikoku Gakushiin (Imperial Academy), Nihon Gakujutsushinkokai (Japan Society for the Promotion of Science: JSPS) and the Ministry of Education. The organizations in the period of wartime already dispersed.

On the other hand, in the fall of 1945, the Ministry of Education called a meeting with leaders of the NRC and the JSPS to discuss changes in the science administration system. They decided to strengthen JSPS from the points of national research management supported by public funds and to promote the utilization of the research results. Then the NRC reduced its number of members from 700 to 300. Further, the Ministry of Education had a meeting with leaders of the Imperial Academy and continued to discuss the following

topics related to reorganization:

- i) The NRC would disperse since the revised Imperial Academy, and JSPS would take over its function.
- ii) The Imperial Academy would add 300 new four-year members. Nevertheless, this number reduced to 150 to keep its quality.
- iii) Its members would be elected by the Imperial Academy members who were selected by other national scientific societies.
- iv) The president of the Imperial Academy also held the post of the president of JSPS.
- v) The members of the four-year term in the Imperial Academy were concurrently the JSPS's standing committee members.
- vi) The Imperial Academy strictly supervises the JSPS.
- vii) The Ministry of Education remained to control the research funds.⁵

GHQ/SCAP Officials considered the reorganization was properly conducted the above proposes supported by the Ministry of Education did not obtain the entire approval. The president of NRC, Dr. Hayashi, resigned in order to be responsible for its incomplete procedures. However, the Ministry of Education continued further discussions. The discussion continued through the fall of 1946, and the NRC planned to dissolve itself by November 28, 1946. On the contrary, the JASL submitted its report with 15 negative review points of the reorganization plan proposed by the Ministry of Education. Soon after the JASL submitted the report, SCAP officials called a conference with leaders of the Imperial Academy and the NRC. As a result, the JASL review did not receive any strong opposition by either the NRC or the Academy. The reorganization plan opposed by JASL dominantly originated from the Imperial Academy, which was responsible for the reorganization of memberships in NRC or JSPS or both organizations. Only a small number of scientists belonged to the NRC alone of the whole planning group.

During the latter half of 1946, the Imperial Academy independently progressed the reorganization of science with the National Diet. In June 1946, Kagaku Gijutsu Seisaku Doshikai (Scientific and Technical Policy Comrades Association) headed by Hidetsugu Tagi, then president of Osaka Imperial University and former head of the wartime

Board of Technology was formed. To respond to the crisis resulting from the defeat of World War II, and to reorganize Japan to a state with robust science and technology, Japanese people had to fully recognize to have the strict national policy and powerful national administration and control of science. This movement became the purpose for the Imperial Academy until mid-December 1946 when SCAP disapproved of the formation of the above association, stating that taking a cabinet-level policy action without enough planning and consideration on a broader scale.⁶

(2) Renewal Committee for Science Organization

The joint meeting of SCAP officials and officials of the Ministry of Education, NRC, JSPS, JASL, and the Imperial Academy held on November 27, 1946, was a turning point. SCAP officials strongly insisted that the organization representatives' planning and deliberation would guide the reorganization of science and technology in Japan. Therefore, they thought the selfish expediency in Japan, though they refrained from providing the Japanese officials any specific plan for reorganizing the science and technology because they expect Japanese scientists should reform their science and technology by themselves. They finalized the plan and deliberation in January 1949, with the establishment of the Science Council of Japan. Thus, the above Japanese officials followed the procedure to find the solution about the reorganization of science and technology, stopped the previous planning to dissolve NRC, and also existed with the Imperial Academy and JSPS. In December 1946, JASL called a meeting of the principal bodies regarding science organization, including the Ministry of Education. There, the participants agreed that the Ministry of Education would form a new committee representative of all scientists and its independence. In order to form the committee mentioned above known as the Gakujutsutaisei Sasshin Iinkai (Renewal Committee for Science Organization), the Ministry of Education appointed the Sewanin Kai (Preparatory Committee) with the full approval of the Imperial Academy, NRC, and JSPS.

The Renewal Committee for Science Organization accepted the following points that the Preparatory Committee indicated.

- i) The Renewal Committee has the purpose of determining the most suitable organization for Japan in

the field of science.

- ii) The organization includes all fields of learning.
- iii) The science in Japan has a relation to politics and society in general.
- iv) The Renewal Committee should concurrently consider applied research and development and fundamental studies.
- v) The Renewal Committee for Science Organization consists of "108 members, 15 from each of the seven main fields of learning and three representing broad interests covering three or more of these seven fields." The seven primary fields are as follows: fundamental natural science, engineering, medicine, agriculture, law, literature, and economics.
- vi) Other than the above central members, additional members from the Imperial Academy, NRC, JSPS, and government offices, and the Diet since a certain kind of close connection with the existing research organizations and the legislative, administrative and social institutions are required. Nevertheless, the Renewal Committee for Science Organization did not adopt this method.
- vii) The Renewal Committee should establish the regional liaison committees for local public relations and adequate exchange of information.
- viii) The Japanese government should establish the Renewal Committee for Science Organization, but in order to obtain funds from the Cabinet, its office should establish in the NRC.⁷

After enough deliberation and consultation, seven broad learning areas, and the eighth section called Sogo Bunya (Compound Section) was created. From the Compound Section, three representatives participated in the Renewal Committee. Six organizations including Teikoku Hatsumei Kyokai (Imperial Invention Association), Minshushugi Kagakusha Kyoukai (Democratic Scientists' Association), Minshushugi Gijutsusha Kyokai (Democratic Technologists' Association), Kagakushi Gakkai (History of Science Society), Nippon Kagaku Gijutsu Renmei (Union of Japanese Scientists and Engineers: JUSE), and Hokkaido Sogo Gijutsu Renmei (Hokkaido General Technologists Association) were approved to belong to the above Compound Section. The number of representatives of each organization varied according to the

organization size, though, it could not exceed nine per organization. Three individuals selected from the representatives of such organizations became members of the Renewal Committee for Science Organization.

The Keizai Fukko Kaigi (Economic Recovery Council) sponsored by private companies promoted economic recovery and concurrently played an important role when communists tended to move independently for the reformation of science and technology in 1947. This Council tried to rehabilitate in the business fields. They were called the "Rehabilitation Councils" in the field of science and technology. Sponsor organizations, which were mainly labor unions of the research centers, the Democratic Scientists' Association, the Democratic Technologists' Association, JUSE mainly supported this Council.⁸

The Council led by Spokesman, Shinichiro Ono, a Communist, needed the SCAP accreditation and support. However, the SCAP advised that the reorganization of science and technology should have progressed altogether with other organizations in Japan. Then, the above movement by the Rehabilitation Councils died, and so did the Economic Recovery Council. The inauguration ceremony held on August 25, 1947, enhanced the prestige of the Renewal Committee for Science Organization. The participation of government ministers, especially Prime Minister Katayama, the SCAP representatives, and the US Science Advisory Group sent by the American Academy of Sciences in 1948, drew international interest.⁹

At the sixth general meeting of the Renewal Committee for Science Organization held on January 30 to 31, 1948, the temporary plan reached the stage that SCAP could examine. SCAP did disagree with the original plan. Then, the Renewal Committee provided the final plan at the seventh general meeting held on March 23 to 24, 1948, with SCAP. The Renewal Committee submitted the final plan to the prime minister on April 8, 1948. The Renewal Committee proposed to establish the Nihon Gakujutsu Kaigi (Science Council of Japan) as a supreme scientific organ in Japan and regional institutions to function locally.

To treat scientific-related matters, the Renewal Committee proposed as follows:

i) To establish a government coordinating organization called the Kagakugijutsu Gyosei Inkai (Scientific and Technical Administration Committee).

ii) To create ministry bureaus in charge of the general management of science matters and research works under the ministry's jurisdiction.

iii) To found administrative agencies to effectively promote basic science, in particular, cooperating with the Science Council.

Before taking office as Chairman, the Science Council's Initiative Preparation Committee was established and was responsible for implementing the reform committee's conclusions.¹⁰

(3) Establishment of Science Council of Japan

The Renewal Committee for Science Organization outlined the following principles in the recommendations concerning the Science Council of Japan to the Prime Minister:

- i) The Science Council of Japan should be legally founded as a representative organization of scientists in Japan. The Prime Minister should supervise the Science Council funded by the Government.
- ii) The Science Council should operate independently. Its mission should deliberate important matters regarding science, making an effort to realize its deliberation, enhance researches to increase its efficiency.
- iii) The Science Council should form a custom of the Government to consult the Science Council always regarding critical scientific matters. Moreover, the Science Council should have the right to make a recommendation to the Government.

Additionally, the number of the Science Council fixed 210 elected by a nationally qualified scientist's vote. The national treasury disbursed the expenditure required for the election of members. The Science Council planned to absorb the functions of the National Research Council and include the National Academy as an honorary organ. A secretariat established in the Science Council of Japan. Based on the report of the Renewal Committee for Science Organization, the Government submitted a bill to establish the Science Council of Japan to the Diet on June 10, 1948. The Renewal Committee requested the Ministry of Education to supervise the administrative work on its establishment. The bill strictly followed the decision of the Renewal Committee. Then, the

House of Representatives passed the bill on July 2, 1948, and the House of Councilors on July 5, 1948.

At first, the Gakushiin (Japan Academy) did not accept the provision of the draft prepared by the Renewal Committee about the way of election of the Gakushiin (Japan Academy) by the Science Council. The Japan Academy appealed to GHQ/SCAP, but GHQ/SCAP answered that the Government recognized Renewal Committee and GHQ/SCAP were competent institutions for deliberating the scientific reorganization. Then the decision could not be changed.

GHQ/SCAP was anxious that the passage of the bill might be delayed due to the Academy's appeal. On June 29, 1948, a GHQ/SCAP officer met Junzo Matsumoto, chairman of the Diet committee, and expressed concern about the possibility that the National Assembly could not pass the bill. The GHQ/SCAP officer insisted that the bill summarized the opinion of the elected organization of Japanese scientists through democratic processes. The Diet session was extended for five days; however, the Diet ultimately passed the bill about the establishment of the Science Council and the Science Council of Japan Law without debate.

Election of the Science Council of Japan was conducted on December 20, 1948, by the election committee appointed by the Renewal Committee under the Science Council of Japan Law and 35,354 votes were cast.¹¹

The election results were as follows:

Tokyo and its immediate surroundings supplied:	112
The total national (former Imperial) university membership:	91
Other national government university and college membership:	25
Prefectural college membership:	8
Government offices and laboratories:	18
Hokkaido:	10
Tohoku (Sendai):	10
Kanto (Tokyo):	113
Chubu (Nagoya):	12
Kinki (Kyoto-Osaka):	44
Chugoku (Shikoku-Hiroshima):	8
Kyushu:	13
Diet House of Councilors:	4
Non-government circles:	64

National Research Council members:	77
The Imperial Academy:	12
Renewal Committee:	42
Communist Party:	26
Communist sympathizers:	40

Chart 1 Election Result¹²

The recommendation for the establishment of the Renewal Committee for Science Organization that the Scientific and Technical Administration Committee was postponed waiting for the Science Council of Japan Law. On November 15, 1948, however, the government submitted a bill to the Diet to set up the Kagakugijutsu Gyosei Kyogikai (Scientific and Technical Administration Commission: STAC) in the Prime Minister's office. The House of Representatives passed this bill on December 9, 1948, the House of Councilors did on December 11, 1948. Then, the Diet enforced this bill on January 20, 1949.

The Science Council of Japan Law stipulated the Science Council of Japan should deliberate and make a recommendation about (1) measures necessary to reflect the reports and recommendations of the Science Council of Japan in the national administration, (2) selection of matters to consult with the Science Council, and (3) coordination of science and technology matters under the jurisdiction of the government agencies.

The effectiveness of STAC was implemented only when its acceptance and prestige influenced more than the representatives' power. The relation with the Science Council of Japan became a good foundation in the government, but the effectiveness was not precisely established.¹³

(4) Assistance of NAS

GHQ/SCAP invited the NAS as the Second Scientific Mission to Japan in the latter half of 1948. The first time when the NAS was August 25, 1947, at the inauguration ceremony of the Renewal Committee for Science Organization. The election of the Science Council of Japan's members was conducted. The bill to establish the Scientific and Technical Administration Commission was ready for deliberation at the Diet.

NAS had two purposes. The first one was to support the Japanese reorganization program and the Science Council of Japan's establishment. The second one was to review, evaluate,

and advise the activities and objectives of GHQ/SCAP in the fields of science and technology for the future. In particular, the Academy made efforts to encourage international relationships and cooperation between Japanese scientists and scientists in other countries for knowledge advancement and peace.¹⁴

The mission stayed in Japan for three weeks since November 28, 1948. The mission concluded that the science of Japan was successfully demilitarized. Moreover, the manners of Japanese scientists toward GHQ/SCAP was excellent. Moreover, the scientific information interchange between Japan and foreign countries started to advance on some level. The Science Council of Japan was expected to build a cooperative spirit among Japanese scientists. The close understanding between the Science Council of Japan and NAS would develop the resume of Japanese international status in the scientific field.

To further promote the GHQ/SCAP objectives, on December 18, 1948, the mission recommended the followings:

- i) Program establishment for advance training of potential leaders in science.
- ii) Financial assistance for a limited number of advanced students to study abroad for democratization and developments in science and industry.
- iii) The exchange between Japanese senior scientific workers and those of other countries.
- iv) Funds appropriation derived from exports for the scientific research facilities.
- v) Establishment of a scientific research and education center throughout the country.
- vi) Encouraging Japanese scientists to devote their works in science fields, including industry, agriculture, and public health.

By the end of the occupation, the above recommendations were realized except for establishing selected scientific research and education center throughout Japan.¹⁵

(5) Technological Reorganization within the Ministry of Commerce and Industry

The Ministry of Commerce and Industry ran 13 laboratories in technical fields for industry and trade enhanced by research and development and contributed to laboratory activities owned by the government where product and

material testing and assisting in the development of industrial standards were required. These laboratories were initially established as service organizations rather than academic research institutions. The close working relationship with each other influenced their effectiveness. The Ministry was responsible for trade and industry from the technological points. Japanese and GHQ/SCAP officials examined the adequacy of these relationships.

Each laboratory reported its activities to the vice-minister of the Ministry of Commerce and Industry. A moderate and cooperative relationship between each laboratory and each bureau of the Ministry, however, many functions per laboratory were related to more than one bureau.¹⁶ The above circumstance meant that such laboratories were not able to have any capable administrative institution inside them to promote their research plans.

3. Contribution of Pharmaceutical Industry in Occupied Japan toward Conformity to Global Standard

(1) Quality Control in the Pharmaceutical Industry

Considering the points of concern, which were mentioned at the end of the previous chapter, this chapter will focus on the activities in the pharmaceutical industry in Occupied Japan. The reason why this chapter chooses such an industry was that the pharmaceutical industry belonged to the non-governmental circles of the Science Council, and primarily it was deeply related to the field of public health. Moreover, the field of public health is one of the critical areas Japanese scientists should have devoted works following the recommendation by the mission of the NAS mentioned in the previous chapter.

The case of Tanabe Pharmaceutical Co., Ltd. (currently Tanabe Mitsubishi Pharma Corporation: written as "Tanabe Pharma" in this paper) may be an example of the successful introduction of SQC to the pharmaceutical industry in Japan. Tanabe Pharma introduced SQC to its pharmaceutical production site. Since 1945, the company which had conducted tailor-style quality control pursued research on quality control centered on the American standard Z1 in the Second World War.

Tanabe Pharma took a series of lectures of SQC taught by Deming conducted by JUSE from July 10 to 18th, 1950. The company adopted the SQC method in the manufacturing process of anti-tuberculosis (TB) drug, "NIPPAS," which uses

para-aminosalicylic acid (PAS) produced in Japan (Nihon) and get outstanding results of quality control. In September 1951, the company received the first Deming Application Prize in the pharmaceutical industry. The Deming Prize and the Deming Application Prize are prizes to be awarded to individuals or companies that have achieved outstanding quality control results following the QC process advocated by Deming during the relevant year.

Winning the Deming Application Prize of Tanabe Pharma has an essential meaning for the pharmaceutical industry. Since we can admit that the stable system supplying significant medical products which secure a fixed quality standard was already established not by the Ministry of Health and Welfare (MHW), namely "government actor," but by Tanabe Pharma which belonged to the "industry actor," when the company adopted the SQC method in its production process of "NIPPAS" in 1950.

The company further received full recognition of its social contribution to the TB control measures and got a distinguished service prize from the Minister of Health and Welfare at the Commemoration Ceremony of Fifty Percent Reduction of TB Mortality Rate held in May 1952.¹⁷

In 1952, Takeda Pharmaceutical Company Limited (Takeda Pharmaceutical), Shionogi & Co., Ltd. (Shionogi Pharma) received the Deming Application Prize. Takeda Pharmaceutical introduced SQC to the medical products producing processes such as penicillin, injection, folic acid, and PAS. Shionogi Pharma adopted SQC for the production process of sugar-coated tablets, including Paraesu vitamin tablets and Tsuberon vitamin tablets, and injection medicine, then, the company conducted highly accurate quality control. The companies characterized the SQC as company-wide quality control with organic linkages ranging from management to workers at the site.¹⁸

The critical point of their company-wide quality control was a collaboration between the company, namely "industry" and the workers as "civilian."

(2) Larger Volume and Higher Quality of Pharmaceutical Products

1) Production of Anti-TB Drugs

On May 6, 1950, Japanese pharmaceutical companies led by Tanabe Pharma, Takeda Pharmaceutical, and Shionogi Pharma received government approval of commercial

production of PAS and began to produce PAS domestically. They produced 565 kilograms of PAS, the most commonly produced and used form of PAS in January 1950 before the commercial production approval. The number of pharmaceutical companies increased to fifteen, and the production volume of PAS reached 24,852 kilograms in December 1950. Then, the production volume of PAS was 141,232 kilograms in total in 1950. According to National Health Insurance (NHI), Drug Price Standard in 1950 provided by the Minister of Health and Welfare, the price for 100 grams of PAS was 2,700 yen in 1950.

The market size of PAS rapidly grew to 3,813,264,000 yen in 1950. A patient needed a 10 grams' dose of Pass per day. The production volume, 565 kilograms of PAS in January 1950, corresponded to the volume of PAS required for 56,500 people per day. The production volume of PAS in Japan increased to the volume that can be administered to 14,123,300 people per day.

For penicillin, Public Health and Welfare Section (PHW) assigned penicillin experts there. In 1946, the total production volume of penicillin was 100,000 Oxford unit, which was equivalent to 23 vials of production, but in 1949, it reached 1,799,000,000 units, which market size is 140yen/100,000 units namely, 2,518,000,000 yen in total. In 1949, 38 licensed manufacturers produced penicillin in Japan.

The government excluded penicillin from distribution control products in 1949 and cut all the prices of penicillin by about 50 percent on October 1 in 1949. In 1950, when Deming introduced SQC in Japan, and Takeda Pharmaceutical adopted the SQC in its pharmaceutical manufacturing process, the annual production volume of penicillin reached 7,495,530,000 units. Its unit price lowered to 45 yen/100,000 units, 32 percent of the previous fiscal year though, the market scale expanded to 3,337,300,000 yen in total.

For streptomycin, in April 1950, five companies, including Tanabe Pharma, Takeda Pharmaceutical, Shionogi Pharma, received the approval for commercial production and started domestic, commercial production in July 1950. The MHW, namely "government," purchased all of the above initial products. The Japanese pharmaceutical industry domestically produced 118,611 grams of streptomycin in total in 1950, only one year later, when they imported 600 kilograms of it in 1949.¹⁹

According to the National Health Insurance Drug Price

Standard in, the TB patient needed intramuscularly injected streptomycin twice or three times a week and from 0.75 to 1.0 grams (titer) per day. The price of streptomycin was 350 yen per gram, which was expensive for patients to pay for it. Its market size was 41,513,850 yen multiplied by its production volume in 1950. In 1952, its production volume fulfilled the domestic demand of Japan, and its export became possible. The MHW stopped its import. The MHW improved the quality of the contents of insurance benefits. The MHW approved the medical experts to use streptomycin in September 1949 and PAS in July 1950 for TB patients. In April 1951, the MHW established a set "guideline of TB treatment in social insurance."

The MHW announced "Standards of Antibiotic Therapy in Social Insurance" in April 1953 and "Treatment Guideline of Venereal Disease of Sailors" in June 1953 together with the full adoption of antibiotics, for example, chloromycetin including penicillin. Since Deming came to Japan in 1950, the stable supply of high-quality medicines produced by the pharmaceutical industry in Japan has become definite. The result of the cooperation between industry and civilians led the government standards and guidelines.²⁰

In this way, PHW Chief General Crawford F. Sams, who encouraged the domestic production of medicines in Japan, achieved his intention. Also, ESS could implement to expand its intention of mass production, exporting high-quality products, and then, led Japan to come back to the international community.

2) Tanabe Pharma Received Deming Prize

Tanabe Pharmaceutical Co., Ltd. was incorporated on December 13, 1933, with a capital of 150 million yen aiming at (i) manufacture, buys and sells general medicines, poisons, powerful drugs, medical supplements, (ii) trades in medical machinery, glassware, rubber products, food products, cosmetics, and others, (iii) conducts agency business on general import and export, and (iv) offers various services regarding the business mentioned above.

Tanabe Pharma was incorporated in 1933; however, it was founded in around 1720 when its the 14th owner, Tanabe Gobi started to sell drugs in Osaka. Since then, it has flourished as a drug wholesaler. Along with the development of western medicine, it strove for introducing high-quality foreign medicine imports in the middle of the Meiji Era,

further began domestic production of medicines. In 1916, it built a full-fledged pharmaceutical factory in Osaka City. In 1925, it built a plant manufacturing salicylic acid and its derivatives in Onoda City, Yamaguchi Prefecture.

Tanabe Pharma gradually organized itself as a modern pharmaceutical company. In December 1933, it changed from its traditional individual company organization to a corporation limited and established the Tanabe Gohei Co., Ltd. In August 1943, it changed the company name to Tanabe Pharmaceutical Co., Ltd. It merged with Mitsubishi Pharma Corporation in 2007, and changed the name to Tanabe Mitsubishi Pharmaceutical Co., Ltd.

Tanabe Pharma has been engaged in manufacturing various medicines antidepressants, new drugs, new formulations, aggressive drugs, poisons, narcotics, etc. contained in the Japanese Pharmacopoeia and National Pharmaceuticals. There were 50 items to be manufactured. The company has been conducting agency sales of teramycin, streptomycin, atphan, lysol, etc., which are high-quality foreign drugs. In the organization, Employees and executives of Tanabe Pharma frequently communicated with each other.

The organization structure is as follows:

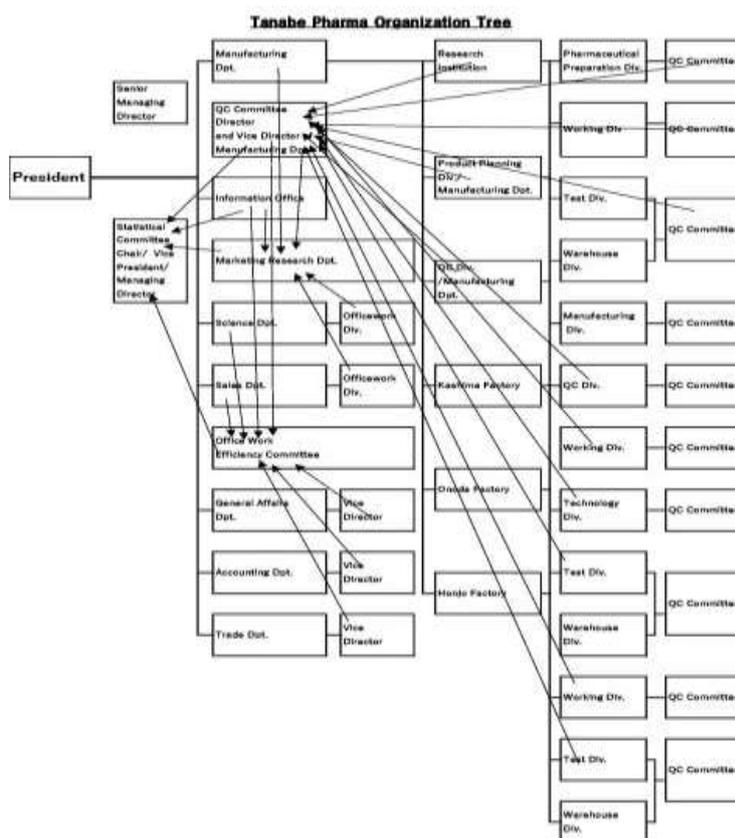


Chart - 1 Organization Tree²¹

3) Kaizen Process in Tanabe Pharma

The following chart shows the process of how to manufacture the anti-TB drug, NIPPAS, adopting SQC. Tanabe Pharma introduced this chart in the statement of the Deming Prize and Ground of Deming Prize Award in 1951.

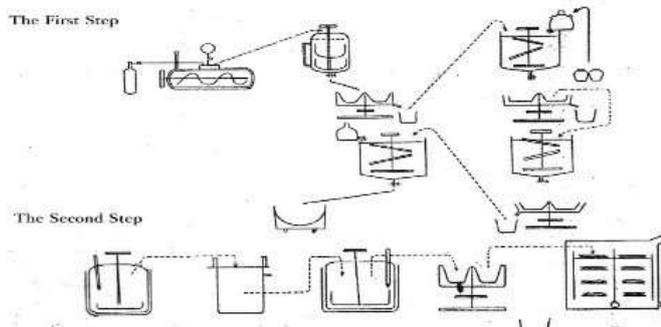
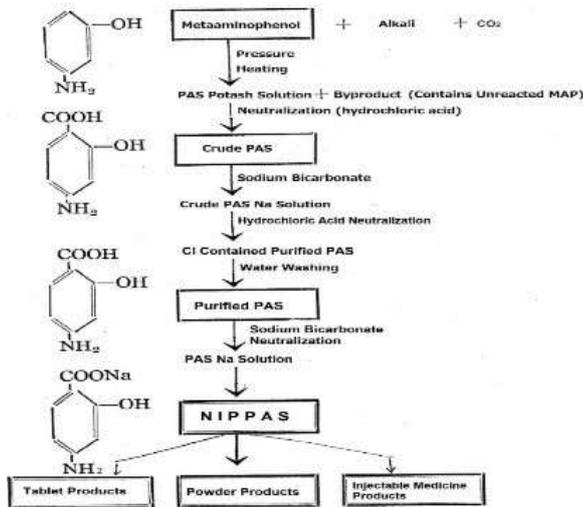


Chart - 2 NIPPAS Production Process²²

Tanabe Pharma used the SQC method in the above manufacturing process. The Company adopted the product yields, for example, using the case of seven caldrons numbering 1 to 7. The staff checked and wrote about products in two caldrons every day. Since each production has a weekly nature, however, Tanabe Pharma classified the checking report as shown in the table below. In this case, it was unclear that different structures of caldron influenced the yield in a caldron or different efficiency of workers changed the yields. The Company did not think the structure of each caldron was

different. For that reason, the Company replaced the location of Worker D and F, but the yield of No. 4 caldron was still low.

Caldron No.	Worker	Yield					Average
2	B	36.2	49.3	43.2	41.3	43.7	42.74
3	C	43.2	44.3	40.0	42.0	39.1	41.72
4	D	37.4	33.2	36.2	36.0	35.1	35.58
5	E	46.7	40.3	40.0	38.1	44.4	41.90
6	F	42.7	42.7	36.5	45.3	44.9	42.42

Chart 3 List of Yield according to Caldrons and Workers²³

Therefore, the Company believed firmly that the structural difference influenced the yield. No. 4 caldron was found that it was not packed sufficiently compared to other caldrons. Because of improving this point and adopting the same measures for other caldrons, the average yield in the process rose to about 47 percent from the following month.

4) Efforts of Tanabe Pharma to Manufacture Anti-TB Drugs Complying with Global Standard

As described in the PAS manufacturing process in the previous section, a mitogen-activated protein (MAP) is required as a raw material for PAS production. As for PAS, by performing SQC, the amount of MAP required for the production of a certain amount of purified PAS decreased by approximately 70 percent, resulting in a profit of 9 million yen per month.

The NIPPAS adopting SQC improved its purity of the product, moisture, appearance, water solubility with extremely stable high quality. As a result, the government purchased the NIPPAS and certified NIPPAS as the first pharmaceutical QCP product in Japan, meeting quality control standards. The PAS manufactured by Tanabe Pharma was named NIPPAS. It means PAS manufactured in NIPPON (Japan). NIPPAS was prescribed for patients with pulmonary TB (exudative), intestinal TB, and pharyngeal TB.

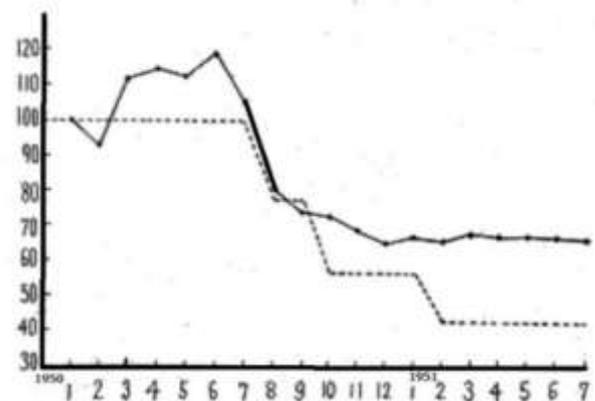


Chart 4 Amount of MAP Required for Production of a Certain Amount of PAS (Assuming the Amount of January 1950 is 100) ²⁴

Chart 4 shows the reduction rate of MAP is higher since July (indicated by a bold line) when Tanabe Pharma started to adopt Deming's SQC method in the manufacturing process. It can be said that SQC was successful.

Tanabe Pharma adopted the SQC method in manufacturing Romezin which was prescribed for patients with acute pneumonia, epidemic encephalomyelitis, fourth venereal disease, puerperal fever, and suppurative trauma. It also searched for the cause of decreasing yield in the manufacturing process and stabilized the production.²⁵

(3) Higher Quality of Pharmaceutical Products at Lower Price

The production volume of medicines annually increased by about 30 percent compared to the previous year caused by the special demand of the Korean War, which broke out in 1950. The drug prices fell sharply. Regarding the drug price, the MHW abolished "Rules for Production and Supply of Pharmaceutical Products and Sanitary Materials" in 1947, aiming at controlling pharmaceutical products and sanitary materials. Instead, the MHW established "Rules for Supply of Pharmaceutical Products (November 11, 1947)" under the "Receipt Adjustment Act of Temporary Goods (October 1, 1946)." According to that Rule, the MHW controlled the distribution of 132 items of medical products, sanitary materials and infant-treatment medical products. The MHW released such controls sequentially and renewed the Rule to "Supply Regulation of Pharmaceutical Products (July 3, 1950)" in 1950.

As stipulated in the above regulation, the MHW supplied controlled medical products through the central distributors and local dealers in exchange for the purchase certificate of designated distribution goods issued by the MHW Minister or the prefectural governors. The MHW allocated goods supply by prefecture, and the prefectural governor issued the purchase order for the goods. In 1952 the MHW eased the control, and end-users could purchase goods freely.

On July 29, 1948, the government enacted the "Pharmaceutical Affairs Law," which stipulated detailed

criteria for antimicrobial substance preparations including penicillin, streptomycin, and others, biological preparation and others. The government promulgated the Sixth Revised Japanese Pharmacopoeia on March 1, 1951, which was based on the 13th Edition of the American Pharmacopoeia and changed from the Fifth Revised Japanese Pharmacopoeia, called "Wartime Pharmacopoeia."

The patients could use their social insurance for streptomycin, PAS calcium using PAS since 1950.²⁶ This fact is important since general people in the actor of "Civilian," who had not been able to purchase the above expensive drugs so far, became able to purchase them thanks to the actor of "Government" who born the drug prices by the assistance of social insurance.

The government enacted the Tuberculosis Prevention Act on March 31, 1951 and enforced it on April 1, 1951. Thanks to the above the law, the TB patients could receive medical treatments at the public expense since October 1, 1951. Nevertheless, the year when the Pharmaceutical Society of Japan thoroughly amended the National Formulary (NF), including the above anti-TB drugs, extended to March 1955.

4. How Did the SQC Transform in Japan?

(1) Did the Quality Control Movement Contribute to the Japanese Economy?

The period from the 1960s to the 1970s is called the "Rapid Economic Growth Period." In this period, small group activities called "QC Circle" were conducted in major companies in Japan. In those activities, the Total Quality Control (TQC) strategy evolved the SQC strategy. Namely, companywide activities were emphasized rather than statistical activities. Improvement was always required to conduct the QC process. Such circumstances, however, sometimes produced "death from overwork" in the 1990s.

Some previous works pointed out that personnel reduction in a workplace resulting from the above QC movement partly increased overwork, which lead to work-related deaths. Deming outlined his theory in 14 positive points and seven negative points when implementing his SQC strategy. The above negative evaluation of TQC or Total Quality Management (TQM) should be reconsidered to clarify how relevant companies at that time adopted and changed the original SQC strategy.²⁷

Attention should be paid to the following case to consider business practice not only in the pharmaceutical industry but also in other industries in Japan. Other than the influence of Special Demand during the Korean War, the production volume of significant drugs showed an approximate 30 percent increase over the previous year's production every year in the 1950s. Such over-production triggered a price collapse of drugs. The price collapse led to the "Underselling in Ikebukuro" case by retail dealers in December 1959. The MHW sent a notice to the pharmaceutical industry to supervise the prices of pharmaceutical products in February 1960, but the Ministry did not put any regulations on prices. So, it turns out that parties concerned should review whether or not the business practice of "Low Profits and High Turnover" is a good one for the current pharmaceutical industry.²⁸

(2) How Did the Private Sector Transform the Quality Control Movement in Japan?

First, in the private sector, a stable and sustainable supply system for high-quality pharmaceutical products was already established in 1950, thanks to the SQC method. By the Pharmaceutical Affairs Law enforced in 1948, the pharmaceutical industry in Japan adopted the SQC method in the production process of their major medical products since 1950 to improve quality control.

As a result, they prominently improved the quality and volume of the products and production processes at low prices. Especially, Tanabe Pharmaceutical Co., Ltd. (Tanabe Pharma) won the first Deming Prize in 1951 and received a performance award from the MHW in 1952 for contributing to a 50 percent reduction of the TB mortality rate in Japan. The TB mortality rate was 110.3 per 100,000 people in 1951. This rate reached about half of 1939 when Her Majesty the Empress conveyed an Imperial message on TB mortality rate. The TB mortality rate in youth and manhood generation was dramatically improved.

This case is very significant for the Japanese pharmaceutical industry as well as Tanabe Pharma. Because a supply system for larger volume and higher quality pharmaceutical products with lower prices were already established in the private sector at least in 1950. Takeda Pharmaceutical Co., Ltd. (Takeda Pharma) and Shionogi and Co., Ltd. (Shionogi Pharma) followed Tanabe and won the

Deming Prize in 1952.

Takeda Pharma adopted the SQC method in its production process. Then Takeda Pharma continued to improve the yield percentage of organic synthetic chemicals and penicillin and decreased inappropriate rates of injection, tablets, and penicillin using their experimental design method. The net amount of Takeda's visual improvement converted into annual turnover exceeded 100 million yen.

Shionogi Pharma improved the yield rate of synthetic chemicals and posted 150 million yen as annual turnover. Its tablets division attained 20 million yen, and the injection division achieved 80 million yen, respectively. Then, the annual turnover of Shionogi 1951 accounted for 250 million yen in total.²⁹

According to the data announced by the Ministry of International Trade and Industry (MITI), the pharmaceutical industry had 972 establishments in 1950, and 979 in 1951. The amount of annual shipment, namely annual turnover, of the pharmaceutical industry in total was around 32.3 billion yen in 1950 and 44.9 billion yen in 1951. The average amount of an establishment's annual turnover was 33.2 million yen in 1950 and 45.8 million yen in 1951.

From the above figures, we can say that the major pharmaceutical companies at that time, including Tanabe Pharma, Takeda Pharma, and Shionogi Pharma, posted a much higher annual turnover than any other smaller establishments in Japan. Directly speaking, they adopted the SQC method after 1950 and achieved a higher amount of annual turnover with the high-quality medical products they specialized in. On the other hand, in the public sector, after the enforcement of the Pharmaceutical Affairs Law in 1948, the renewed Tuberculosis Prevention Act (Act No. 96 of 1951) was not enforced until March 31, 1951. Further, the Japanese Universal Health Insurance System to cover anti-TB drugs, including streptomycin and PAS, was only finally established in 1961.

In July 1949, the American Pharmaceutical Association Mission (Chairman: Dr. Glenn L. Jenkins) came to Japan and advised on the separation of medical practice from pharmaceutical dispensing. However, the separation of medical practice from pharmaceutical dispensing did not become effective until April 1, 1956.³⁰ More than ten years passed to realize a stable supply of pharmaceutical products through a public framework. In the private sector, the SQC

method given by Deming contributed to the stable supply system for high-quality pharmaceutical products at least six years earlier than the public sector.

(3) Didn't the Pharmaceutical Industry Development Use SQC to Bear Any Challenge Points?

The "Industry" of the pharmaceutical, which supplied mass volume of the high-quality pharmaceutical products at a lower price by adopting the SQC method to the production process, led the public health in occupied Japan supported by the legal system improvement by the "Government." The government took over a part of the medical expenses of the people by the universal healthcare insurance. People who were consumers and general public belonging to the actor of "Civilian" could frequently access high-quality medical care and pharmaceutical products.

Nevertheless, the companies which adopted the SQC method had some problems that they heavily relied on its statistical methods. The companies' top management, which adopted the SQC, tended to lack understanding it deeply.

Joseph M. Duran, who came to Japan in 1954 as a successor to Deming, presented a new view on management's responsibility for improving quality and productivity. Duran, who instructed the quality control in Japan as a successor to Deming, advocated the total companywide quality control (TQC) while following the quality control theory advocated by Deming. This TQC was later criticized as managerial labor-management leading to death from overwork.

The number of people who could frequently access high-quality pharmaceutical products drastically increased by the SQC and the universe healthcare insurance system. That fact means that people have had the society with good and evil elements where people have to live long with the iatrogenic disease, drug-induced suffering and intractable disease in the environment where all the people have shared the paradox generated by advanced medical treatment as Sugiyama points out.³¹

5. Conclusion

The United States, which led the occupation, was responsible for reorganizing Japan's science and technology and returning Japan to the international community. Based on the recommendation of the Second Science Advisory Mission from the United States who visited Japan in 1948, ESS started

reorganizing Japan's science and technology having followed the policy change of the United States in 1949.³²

Reduction of the mortality rate was desperately necessary for Japan, and development of the pharmaceutical industry was urgently required. However, at the beginning of occupation, proper quality control of the Japanese pharmaceutical industry was the most urgent task.³³ Deming, who was appointed from the ESS in 1950 and invited from JUSE which was a Japanese professional organization, came to Japan as Advisor in Sampling, Bureau of the Budget, Executive Office of the President Truman of the United States, and instructed the SQC.

Deming, who was also be Advisor in Sampling, Bureau of the Budget, Executive Office of the President Truman and a Professor of New York University, embodied the actors of "Government" and "University." He gave lectures on quality control of weapons to workers who has no skill during the World WarII. In the later years, Deming, who added the attitude of management who should understand the whole company, actively recommended business people who are actors of "Industry" in Japan, and give lectures on SQC to engineers who belonged to the actor of "Civilians" and scholars who belonged to the actor of "University," from the point of "Government," "University" and "Civilians."

The reason why ESS appointed Deming to instruct the SQC to the Japanese pharmaceutical industry was that ESS expected the pharmaceutical industry in Japan would produce a large volume of high-quality pharmaceutical products at low cost, would export them and would return to be a member of the international community. The SQC, a measure to mass-production of high-quality pharmaceutical products inexpensively, was an essential technique for PHW, MHW and the pharmaceutical industry in Japan to reduce the mortality rate, which was the most important issue of the public health in Japan at the time to confirm with the global standard which was required to return to the international society after World War II.

In February 1951, in the second half of the occupation, the John Foster Dulles Mission, General Douglas MacArthur, and the ESS Chief, William Frederic Marquat, requested the third Yoshida administration directly for Japan's economic cooperation with the Truman regime which expected Japan to expand the quantity of high-quality military production.³⁴

The reason why the United States, which led the occupation, introduced the statistical quality control (SQC)

having been used in the military field in the United States to occupied Japan and promoted the development of Japanese pharmaceutical industry was to the promoted Japanese economy and to decrease TB mortality rate in 1950 when the United States first introduced SQC. However, since 1951 when approaching the end of the occupation, the United States intended Japan for its economic cooperation from the point of expanding military production for the United States.

It is noteworthy that the economic strength of Japan reached the point where it could immediately respond to the request of the United States for expansion of military production from the viewpoint of the economy in February 1951.

The purpose of this paper is to specify the reorganization of Japan's science and technology by GHQ, including the

perspective of public health quality control for transforming Japan into a supply base that conformed to global standards for the world, not just for the United States as stated in 1. Introduction. GHQ/SCAP worked on the reorganization of Science and Technology institutions of the governments, universities, and industries in Japan, then introduced the quality control system to improve the public health in Occupied Japan according to the recommendation of the Second Scientific Mission to Japan in the latter half of 1948. SQC advocated by Deming later called TQC or TQM instructed by Duran improved not only the pharmaceutical production process but also became the Japanese economic driving force to conform with global standards, which were expected all over the world.

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