

Modern Industry and Its Cultural Assets: An Approach to the Knowledge-Intensive Economy through Museum Activity*

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1. Introduction: Development of the Industry-Culture Relationship

Industrial heritage, including industrial monuments, is a major resource for the historical investigation of the past performance of our civilization, and it should be a natural way to enhance the academic study of history by means of that matter. Developed areas and countries have a new mission to conserve and study these materials. The long history of the industrial civilization of society is now in a transient stage, from a society based on material production to a knowledge-intensive society. Our industrial heritage is now expected to have a new role in regard to cultural assets. Based on these new businesses might be developed to fulfill the needs of the knowledge-intensive society. Thus, we should redefine the relationship between industry and culture. This article deals with the new trend toward the performance of industrial heritage in a historical context.

Another important problem is the changing mission of museums, which have long collected and displayed cultural assets. Globally, museums are facing the new challenges of expanding and becoming qualitatively diversified. Serious discussions are underway regarding museums under threat from other institutions, which are now growing as a result of information technology. We must remember that modern museums were developed in close connection with modern nation states and colonialism; hence, they should

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(1) Sharon Macdonald and Gordon Fyfe (ed.), 1996, *Thorizing Museums: Representing Identity and Diversity in a Changing World*, Blackwell Publishers/The Sociological Review. See Introduction by Sharon Macdonald. pp.1-18.

be undergoing a paradigm shift in the current post-modern and post-colonial situation. Science and technology museums must not be exempt from these changes. They had a mission as educational institutions for science literacy in the Western cultural context. How such a mission of enlightenment can be justified in a multicultural and post-colonial world is one of the most critical questions regarding science and technology museums and their activities.

According to the famous Petty-Clarke-Kuznetz Law, the increased share of the service sector means the economy is entering an advanced, mature stage. A pioneer work of Fritz Machlup showed that "knowledge" already occupied more than 40% of the GDP of the United States at the end of 1950s.⁽²⁾ The knowledge-intensive economy is a natural outcome of the economic development of modern nation states. In the 1970s, people began to discuss the post-industrial, knowledge-intensive economy. However, there remained the question of how intellectual or cultural activities were to be treated as products in the framework of economic studies. There is no scarcity of knowledge, and it is never exhausted after being publicized and consumed. Of course, scarcity is one of the fundamental features of goods in a market economy.

Several solutions have been proposed and tested. One of the most popular is the intellectual property system, which has a long history in the development of modern capitalist society. Incorporating the concept of intellectual property into the juridical system of the business world, the patent system was established in the early stage of industrialization. As is widely known, many inventions, or industrial properties, have promoted technology transfer in economic development since the Industrial Revolution.⁽³⁾ This system is an artificial way of treating knowledge as a scarce commodity in the economic world. This "artificial way" is, however, often an origin of conflict between the supplier and consumer of knowledge, as we have seen in so many trials about patents.

Another way of incorporating knowledge into the economic system is to introduce the concept of social capital as an economic infrastructure. The accumulation of knowledge or cultural assets would create a suitable infrastructure with which to build regional or national economic activities. This concept is very attractive and is favored by many economists and planners. However, there are no common quantitative ways of evaluat-

(2) Fritz Machlup, 1962, *The Production and Distribution of Knowledge in the United States*, Princeton UP.

(3) Fritz Machlup, 1958, *An Economic Review of the Patent System*, U.S. Congress, Senate, Committee on the Judiciary, Subcommittee on Patents, Trademarks and Copyrights, Study No. 15, Washington D.C.

ing the accumulation of social capital.

There is a further question regarding the relationship between culture and industry : how to understand the cultural aspect of industrial products and processes, especially of those in modern industry. Traditional agriculture was integrated into the cultures in regions where farming developed. In addition, we can recognize the cultural nature of handcrafts of the proto-industrial stage. However, most mass products and their manufacturing systems are rather culture-blind. From an aesthetic point of view, they are sometimes ugly items. Nevertheless, if we treat them as cultural assets, we must find methods for the cultural evaluation of those items. One such method is described as follows.

First, even in modern mass-produced items and "ugly" machines, we can find some aesthetic value. As in the case of traditional arts and crafts, for example, the industrial design of modern industrial products meets not only practical but also artistic needs.

Second, for each product, including consumer goods, machine tools, and parts, additional knowledge of its provenance is often essentially valuable. When was it produced? By whom was it produced? From where was it transferred? Most of these questions are related to the historical investigation of industrial technology. Accumulation of such knowledge should compose a cultural asset.

To sum up, industrial heritage and industrial monuments have their own cultural value by integration of material aspects and informative aspects. This problem should be considered from a historical context.

2. Past Performance and the Cultural Aspect of Modern Industry: A Historical Overview

Generally speaking, in our modern industrial society, old, used goods and out-of-date manufacturing systems have no practical or aesthetic value. They are regarded as useless or as depreciated capital. If they were recycled to produce some useful goods, once wasted materials have changed their original quality. Their values are never conserved. However, since the 19th century, the conservation of products and manufacturing systems has been a museum activity resulting from the widespread influence of the rise of the modern nation states in Europe and North America. In the 20th century, the modern museum movement developed in several different directions. Colonialism versus post-colonialism, modernism versus postmodernism, and globalism versus regionalism were issues also in the museum movement. Industrial heritage and monuments became signifi-

cant in those complex situations. A brief overview of this development at national, regional, and enterprise levels is given below.

2-1 Birth of National Science and Technology Museums

In the last half of the 18th century, states devoted assets and art collections of the older monarchy or regime to build up their national museums. After 1840, nationalism in the museum movement entered a new phase.⁽⁴⁾ Under the leadership of the rebelling bourgeoisie in newly emerged “modern nation states,” new national museums and national museum associations were established. The Industrial Revolution, the basis of the nation states, was extremely important. As is well known, in 1851, the First International Exposition was held in London to establish the reputation of the United Kingdom as the first industrial state. Some monuments, such as the Crystal Palace, were built and conserved to celebrate the success of the exposition. The national delight in industrial development was represented by a new museum, the Science Museum at South Kensington. Still on display in the big entrance hall are several huge but somewhat clumsy 18th-century heat engines, reminders of the Industrial Revolution in this country.

Thus, the peak of each industrial state is displayed in science museums or museums for the history of technology. Examples include the Deutsche Museum in Munich, the Smithsonian Institution in Washington, and le Conservatoire des Artes et Métiers in Paris. Nowadays, many newly industrialized countries are establishing such national museums to strengthen their national identity.

Japan has no such museum, though this country has unique and remarkable experience in the development of modern industrial technology. EXPO'70 Osaka, which was held in 1970 as the first EXPO in Japan, was a good opportunity to establish Japan's National Science and Technology Museum, but only the National Ethnic Museum was opened. The director of that museum, Dr. Umesao, proposed the National Museum of History of Industrial Technology in 1979. Since then, many people have responded favorably to his proposal, and much research and planning have been done. A large number of items for the future collection of that museum are stored in a warehouse. The plan for the museum, however, has not yet been realized. One of the most critical reasons is the decline of the Japanese economy, but this writer thinks that the overestimation of infor-

(4) Martin Prosler, (1996), *Museums and Globalization*, in Sharon Macdonald and Gordon Fyfe (ed.), 1996, *Thorizing Museums: Representing Identity and Diversity in a Changing World*, Blackwell Publishers/The Sociological Review, pp. 33-35.

mation technology is another reason.

At EXPO70, many beautiful virtual reality displays dominated most pavilions of participating Japanese companies. They were an interesting feature of the EXPO and might be a genuine prediction of future exhibitions of the new knowledge-intensive society. However, we must remember that real objects are always very important for the investigation of past industrial technology.

Monumental collections of past industry consist of old machines and their parts, sometimes with odds and ends of raw materials and intermediate products. These items might have no value without a historical knowledge of each item. Thus, both archives and real objects are necessary. Further, such a collection is not always considered as precious as an art collection is. A hands-on system or interactive exhibition might be essential. Such characteristics of a science and technology museum are part of the "Danilov Paradigm," developed by Victor J. Danilov, who had been the Director of the Chicago Science Museum.⁽⁵⁾ However, the paradigm, dominated by concepts from the Enlightenment, focuses on the function of the experience-oriented, 'nuts-and-bolts museum' for science education. The establishment of a National Museum of History of Industrial Technology in the future should be based on yet another new paradigm.

2-2 Regional Museum of Industrial Technology

In the history of technology, 1932 is known as the "miracle year." In that year, three important books were published.⁽⁶⁾ The authors were respectively Marc Bloch, R. Lefevre de Noette, and F. M. Feldhaus, all outstanding scholars. Their works led to a radical change in our historical picture of Medieval Europe. Since then, to the historian of technology, Medieval Europe has been not the Dark Age but the Age of the Power Revolution and Mechanical Skills. The contribution of these authors was based on virtually endless investigation into rural communities. Objects of their research covered wider areas than those of ordinary academic research: from farming tools, harnesses, and manufacturing apparatus to living items and folk-art articles. Some of them and their

(5) Victor J. Danilov, 1982, *Science and Technology Centers*, MIT Press.

This book is one of the best handbook of museum and museum operation.

(6) Marc Bloch, (1932), *Le Caracteres originaux des L'histoire rurale francaise.*

Le Commandant R. Lefèvre de Noëttes, (1932), *L'attelage at le Cheval de selle a travers les ages*

F. M. Feldhaus, (1932), *Die Technik der Antike und des Mittelalters.*

Their works also made apparent the essential role of technology transfer from Asia and Middle East in civilizing Ancient and Medieval Europe.

followers are often called l'ecole d'Annales, as their main works were published in a famous journal, *Annales d'histoire des sociales et économiques*.

Before the 19th century, the mainstream of historical learning was the political history of kingdoms and nation states. Latecomers were cultural history, economic history, and social history. The history of the Industrial Revolution was one of the most remarkable of these branches of history. Around the miracle year, the social history of regional rural communities was established as a new discipline to open the way for the history of technology. This new field of learning was interrupted with WWII, and one of the leading scholars, Marc Bloch, was killed by the Nazis. After the war, however, investigation of regional history flourished. Regional historical resources, not only written or printed ones but also material monuments, including old tools and furniture, were conserved. These resources became the collections of new regional museums and archives.

In the 1970s, a new discipline emerged. The method for the regional study of rural communities was applied to the modern history of the process of the industrialization of Europe, especially to that of 18th-century England and Scotland. Related to the conservation movement, including the National Trust Movement, it has developed as a new discipline, industrial archeology⁽⁷⁾. Thus, the so-called 'field museum' has developed in several old industrial areas. One of the most remarkable is the Ironbridge Gorge Museum, established in 1959. It is located at the site where Derbies' Coalbrookdale iron works first operated a high shaft furnace with coke in 1709. These field museums have become important resources for sightseeing businesses and have helped to revitalize regional economies.

Also in Japan, the historical study of traditional regional communities flourished after WWII. Now, each local area has its own archives and museum to record the past performance of grass-roots activities. This trend allowed new perspectives of Japanese history, especially that of its proto-industrialized period. For example, the historical investigation of 'Buraku,' a community that was discriminated against, clarified the history of the traditional non-agrarian manufacturing and transportation sector, which was carried out by these people.

Yet, in Japan, because of strong restrictions on land use, the promotion of field

(7) R. A. Buchanan, (1982), *Industrial Archaeology in Britain*, 2nd edition, Penguin Books. The first edition was published in 1972.

Barrie Trinder (ed.), (1992), *The Blackwell Encyclopedia of Industrial Archaeology*, Blackwell. This big volume (xxii+964pp.) is the most comprehensive reference book, including good bibliography and index.

museums is almost impossible except in rare cases: mines in mountainous areas and large-scale public facilities. There are almost no ruins of factories or manufacturing firms in Japan. New ideas are needed to solve the difficulties facing industrial archaeology in this country and to conserve the industrial heritage. For example, establishing a close relationship with the tourist industry and utilizing renovated firms for new businesses are more important in Japan than in Europe and North America.

One more important mission of regional museums had developed in the past, though people are not always aware of its significance. It was the concept and practice of the Museum of Economy and Society at Vienna, which was founded by Otto Neurath, one of the leading scholars of the Vienna Circle, in 1925. The aim of this museum was public education and social information.⁽⁸⁾ Missions of this museum included the promotion of economic recovery and social reform of 'Red Vienna' under the City Administration of the Social Democratic Party in the Austrian First Republic. To this end, Neurath had developed many kind of museum activities, involving pictorial displays of statistics and policy agenda of economy and society. But, this museum was shut down by Drefus coup-de-tat, the right wing rebellion in 1934. However, the heritage is useful for the coming mission of regional museums in the future.

2-3 Enterprise Museum and Record of Industrial Technology

Enterprise is fundamental in an industrial society, but the enterprise system is not always thought of as a permanent system. Assuring its continuity beyond the life of its products and services requires a continuous effort to renew the corporate strategy. Not only must new products and services be developed, but also the corporate identity and the corporate culture, which might be distinctive from those of other companies, must be established and clarified. One of the important tools for acquiring social recognition of corporate activity is the business archive, which is an accumulation of records of past performance for each enterprise. For example, some big companies such as Siemens and Ford Motors have their own museums and archives to record their own business history. Universities and research institutes also prepare archives. In Japan, except in some special cases, there has been no such tradition. Furthermore, since the 1990s, due to economic recession, some Japanese companies have closed their business archives and

(8) O. Neurath, (1925), *Gesellschafts- und Wirtschaftsmuseum in Wien*, *Oesterreiche Gemeindezeitung* 2. No.16, repr. in O. Neurath, (1991), *Gesammelte bildpädagogische Schriften*, ed. By R. Haller and R. Kinross, Vienna.

museums.

However, since the 1990s, an important mission of business archives and museums has been emerging, though it is not recognized by all businesspeople. It is paradoxical to consider the above-mentioned trend of cost-cutting management.

In the 1990s, people became aware of the necessity of the management of technology, MOT, to enhance R&D activities and science and technology commercialization in high-technology industries. In the 1970s, the long-standing belief in the linear model of R&D had begun to fade. People were recognizing that there was no natural linear flow of knowledge from basic study to market via applied research and R&D. The real R&D situation is much more complicated. In high-technology industries, there are many cases, which are driven by market, involving basic study. Good performance of such complex processes requires suitable concurrent management of mutually different activities. Further, large investments in both sophisticated manufacturing systems and highly talented people are necessary but very risky without sufficient management knowledge.

Therefore, the study and practice of MOT has become popular, and graduate MOT programs have flourished since the early 1990s. Currently, there are about 200 programs in the world, but, as in MBA programs, many rich case studies are needed in order to make an MOT program competitive. In other words, collected R&D and the commercialization of R&D experiences are the keys to a successful program and can lead to the success of management in high-technology firms. In Japan, these programs were incorporated into the OJT system of each company, and there were almost no graduate programs in Japanese universities till 2000. Recently, however, people have begun to recognize that, first, in a rapidly changing business climate, companies cannot wait so long to get trained talent from its in-house OJT. Second, the most essential lesson might be learned through cross-sectoral or cross-business communication, and this is impossible with in-house education.

Thus, business archives and museums are now being seen in a new light. They are, in a sense, the new infrastructure to promote innovation in management and technology. Of course, to fulfill this purpose, these institutions must be changed. Enterprise museums and archives should be opened to the public, especially to researchers. Collections must be treated as a common social capital through which the next stage of industrial development might be planned and performed.

Though this last mission is not always popular in the business community, some pioneers are becoming aware of the importance of historical collections. A paradigm shift

for industrial history museums is expected. It might be corresponding to the business version of the Museum of Economy and Society at Vienna.

3. Structural Changes in the Knowledge Economy and Its Cultural Implications

Ongoing changes in the industrial structure are affecting industrial heritage and monuments as cultural assets. The negative influences are summarized as follows.

(1) Vacancy problems in developed countries and outflow of cultural assets

There has been a massive transfer of manufacturing firms from advanced countries of Europe, North America, and Japan to developing or newly developed countries and areas. This transfer is resulting in the outflow of technical skills and management know-how, which had been constructed on the cultural basis of their mother countries or areas. This might mean the invisible outflow, or destruction, of the manufacturing culture.

(2) The black box as a feature of high technology

Recent sophisticated manufacturing systems are in a kind of 'black box.' Skilled workers who have enough capability to see through the box are retiring. This loss is a crisis not only for businesses but also for cultural traditions in once-prosperous manufacturing areas.

(3) The non-material nature of the postindustrial economy

The knowledge-intensive economy might mean that an ever-expanding service sector, or monetary business, supersedes manufacturing to diminish the social significance of real objects. This phenomenon was seen at EXPO70, where visual exhibitions prevailed.

(4) Prevailing homogeneity in the global economy

The so-called globalization of the economy is bringing homogeneity into the world economy. Cultural differences among regional and national economies might be lost. The expansion of global digital technology is further promoting the cultural uniformity of the world. A kind of cultural crisis is emerging because culture is essentially the product of local activity.

On the other hand, we can see some positive aspects of the knowledge-based economy to raise the value of cultural assets.

(1) Revival of craftsmanship in some sophisticated products

Some segments of the manufacturing industry of advanced countries are concerned with product diversification in response to individual preferences of consumers. These businesses intend to produce handcraft-like goods which might reflect the cultural aspect

of each local community.

(2) Possible new residential-industrial complexes

At the workplaces of high technology industries, the image of the dirty factory is vanishing. Instead, software factories and highly sophisticated manufacturing systems which require ultra-clean environments are prevailing. This situation might promote the fine regional environments of residential-industrial complexes and result in enriched cultural assets.

(3) Close relationship between knowledge and industry

As a result of the current R&D model in high-technology industries, the proximity of R&D and manufacturing and marketing is becoming an essential feature of contemporary regional policy. Learning institutions, which hold many cultural assets, should build close ties with industries.

(4) Possible software engineering in cultural activity

As mentioned in the previous section, the progress of visual display technology is not always favorable for the museum culture because the beautiful operation of virtual realities often provides incorrect information about real objects. Nevertheless, adequate utilization of information technology may open as-yet-unknown possibilities for exhibition techniques.

Stakeholders and activists working at the national, regional, and enterprise levels can promote cultural policies to enhance these positive aspects. Local development has a key role because culture is essentially a local matter. Activism at these levels is one of the most important counter-powers against the ongoing extreme globalization of the economy, which could destroy our multicultural world.

4. Regional Development Policy in Terms of Cultural Assets: A Lesson Found in a Japanese Case

In Japan during the late 1930s, under the total wartime mobilization policy, centralized power was strengthened to manage the whole war economy. This centralized power system survived after Japan's defeat in WWII in 1945, and bureaucracy was substituted for the collapsed military power, being subjected to the Allied Occupation Power. This system survived and performed effectively in the rapid economic growth of the 1960s. To achieve balanced development in the nation, Japan instituted the National Land Policy. Combined with the industrial policy, it provided this country with remarkable conform-

ity. Unfortunately, the rich local Japanese culture, which had achieved high maturity through a long history, began to decline.

The conservation of the traditional culture of pre-modern Japan fared rather well because of its artistic and religious value, but the industrial heritage was neglected and lost during the process of modernization. The reasons for this outcome were numerous and included wartime destruction of social capital by Allied air raids and the low priority placed on cultural issues in the rapid recovery and growth of the post-WWII economy. One of the most essential factors was the lack of recognition of the cultural value of the industrial heritage of modern industry. In the 1970s, especially growing concern about environmental problems created a widespread negative image of factories as sources of pollution. Old factory systems became anti-environmental symbols and cultural deficits of the civil society. Housing areas, where people could enjoy their cultural life, were supposed to be separated from dirty industrial areas.

In the 1970s, the Urban Planning Act was in action, and the Restriction of Factory Siting Act was strengthened, and zone-planning policies were introduced in the main metropolitan areas of Japan.⁽⁹⁾ In this juridical system, factories meant not only manufacturing firms but also colleges and universities. As a result, new universities and colleges and new departments of existing ones could not be established in major metropolitan areas. Important centers for cultural activity became scarce there. Such was also the case for new factory systems, software laboratories, and sophisticated manufacturing firms. Soaring land prices in the bubble economy of the 1980s promoted this situation. Thus, the downtowns of big Japanese cities began losing their position as cultural centers.

This writer's conjecture is the decrease of the both cultural values, of local areas and of big cities, is a deep-rooted origin of the serious economic recession since 1990s.

Very recently, under deregulatory policies instituted during the economic recession, the Restriction of Factory Siting Act was abolished, but the way to revitalize local areas is still unclear. While the number of apartments is increasing in downtown areas, office space will decrease because office work is performed more efficiently by means of computer and communication technology. Universities remain in the suburbs except for small satellite campuses in downtown. Traditional shopping zones and small factory complexes are still declining. Most big laborsaving factories are in remote areas because of low

(9) Kunio Goto, (1995), The Second and Third national Development Plans, in S. Nakayama, K. Goto, and S. Yoshioka (ed.), (1995), *The Social History of Science and technology in Contemporary Japan* vol. 4 pp. 226-236 (in Japanese), Gakuyoshobo.

land prices and ease of factory planning.

A possibility now being pursued is to build housing complexes and manufacturing firms on the basis of their cultural assets, focusing on industrial heritage and monuments of the past prosperity of the areas. These assets are expected to become the most important tourism resources. Tourism is underdeveloped in Japan though it is one of the most important industries of the next generation, and museums, especially museums of industrial technology, might have an essential role in its development.

5. Conclusion

In his comprehensive book about 'Science and Technology Centers,' Victor J. Danilov gives a unique historical sketch of the development of technical museums.⁽¹⁰⁾ He regards the Deutsche Museum in Munich as a representative case, but his picture is essentially influenced by the Enlightenment spirit of Western culture. As stated previously, his museum is essentially a science education institution. He has shown the way to give cultural value to nuts and bolts through the experience of children and adults who enjoy hand-on activities in a new museum. His museum belongs to a new paradigm, a shift from the conventional image of museums where people admired precious ornaments in glass cases. He referred the description of R. S. Bhathal, Director of Singapore Science Center, who called the shift by "quiet revolution".⁽¹¹⁾ His science education, however, describes the excellent truth and progress of Western science and technology. But, he does not forget to include minorities in his membership program.

A further paradigm shift is needed : the interaction of past and present, diverse industrial experiences, and different cultural backgrounds. And, it should be a basis of vitalization of regions or nations, including new business creation.

A history of technology museum planned in Kansai, Japan, is the best way to realize this objective. Kansai is the heartland of traditional Japan, where Asian cultural assets have accumulated since the 6th or 7th century. In the 19th century, this area was one of the most important bases of industrialization of modern Japan. Now, this small area has all kinds of manufacturing sectors of contemporary high-technology industries.

What kind of museum should be established? The plan, which has long been discussed

(10) Victor J. Danilov, 1982, *Science and Technology Centers*, Chapter 2 pp.13-41. MIT Press.

(11) Victor J. Danilov, *ibid.* p.41.

(12) The Society has continued planning works since 1980s. The presented is a part of the report, finished in the fall 2003, supported by the Kansai Research Institute, the Promotion Foundation of the Kansai Science City.

by members of the Japan Society for the History of Industrial Technology, is briefly presented below.⁽¹²⁾

According to the proposed plan, the museum should be composed of several sections:

(1) Research Center

At least four divisions are necessary : history of science and technology, business history in technology, social history in technology, and cultural study.

(2) Archives and Warehouse

This section must include three divisions : a library and archives ; a warehouse for industrial monuments, including 'nuts and bolts' ; and an experimental laboratory involving a small factory for trial manufacturing. The last item is critically important because without it, the analysis and the evaluation of industrial monuments might be impossible.

(3) Social Activity Center

Education and business activities are necessary. The former includes science education, library and information science, and MOT. The last may include a business incubator for culture based companies.

(4) Exhibition Hall

This is the museum in a narrower sense, providing space for various research and activities.

(5) Support System

The mission of the support system should include necessary secretarial work and the development and performance of an information infrastructure.

To conclude this writer would propose three paradigms of the modern science and technology museum, tentatively.

The first, there are many traditional "hand-off", object-oriented museums, displaying the relics of great heritage, or past prosperity, of nation states, regions, and enterprises. Though it is challenged by new environment, this traditional case is still prevailing.

The second, "hand-on", experience-oriented museums, or the science and technology centers are now working worldwide. Science and technology education is the first mission of this museum as Danilov has emphasized in his book.

The third paradigm, museum as a cultural-industrial complex, is now in constructing. It might be a social institution of the knowledge-intensive economy, based on multiple

theoretical and practical trials, including a short experience of the Museum of Economy and Society at Vienna (1925-1934). Such complex is expected to provide our society with a new perspective of science, technology and society by means of a contextual investigation of industrial heritage and monuments.

Of course, these three are not mutually exclusive. Rather, coming new paradigm of contemporary science and technology museums should include essential function of the preceding two.

This writer is hoping that the proposed museum of the history of industrial technology should contribute to create the new paradigm of science and technology museum.