



The Common Integration¹ The Group Operation of Petrochemical Complexes in Japan

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Abstract: Oil and petrochemical companies are in the severe situation where they should deal with various problems. In Europe, America, the Middle East, and East Asia (China, Taiwan, and South Korea), one company usually builds a large-scale factory, and consistently produces oil and petrochemical goods in the system of one company. Differently from it, two or more companies are concentrated in the coast landfills in Japan, and generally manufacture in the system of groups. The system of production in a petrochemical complex would be a medium-scale level if it sees worldwide. After World War II, capital was insufficient in Japan. Many companies advanced to the oil and petrochemical industry which seemed to have a big future. Small and medium scale factories were constructed. As a result, petrochemical complexes have been formed with the system of groups.

After the defeat of World War II, many oil companies excluding Idemitsu Kosan Co., Ltd. were organized for the supply of crude oil from European and American oil majors. They were devoted to refining oil and selling it only in Japan. Moreover, the oil market in Japan had been defended by restriction of the government. Such a system continued for years. Therefore, domestic oil companies had been aiming at improvement and efficiency of refining capacity. Their concentrating on technological development, cost reduction, and domestic share fought in the same industry had become a main activity. The construction of global competitiveness had been postponed for a while. However, after repealing protected laws, the import liberalization of petroleum product had been taken since 1996, and cheap petroleum products had flown in from foreign countries. The sales price had not become the same, and free competition under market mechanism had started. As a result, the movement of industry reorganization had been accelerated.

In such a severe situation, oil and petrochemical companies came up with the idea of business cooperation in the same region in order to acquire global competitiveness. 20 companies in oil industry and chemical industry gathered round at first. Under the Research Association of Technology Law, Research Association of Refinery Integration for Group-Operation (RING) was established in 2000. In order to gain global competitiveness, RING has acted group-operation programs in the industrial complexes in Japan. In this paper, I describe the historical formation and development of petrochemical complexes in Japan. And I consider and analyze the approach to and ways of the high-level integration for group operation. And I will explain the meaning of the plans, and the economies arising from the group operation business.

Keywords: petrochemical complex, oil and petrochemical industry, group operation, sustainable development, business cooperation, energy conservation, environmental measures, industrial complex, management of sustainability

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INTRODUCTION

The circumstances that surround the oil and petrochemical industry recently have been severe. Oil and petrochemical companies are in the situation where they should deal with various problems. These subjects are global competitiveness setting between oil and petrochemical companies, sudden rise of price of raw material, response to environmental issues, minimization of resource energy consumption, security of safety technology, employment and economical contribution to the region, requirement to satisfy severe product quality standard, further upgrade and cost reduction in system of production, and construction of system of production to share at sustainable development etc.. In Japan, oil and petrochemical companies have taken up matters of energy saving measure, actions on environmental problems, security of global competitiveness, and restructuring of system of production etc..

In Europe, America, the Middle East, and East Asia (China, Taiwan, and South Korea), one company usually builds a large-scale factory, and consistently produces oil and petrochemical goods in the system of one company. Differently from it, two or more companies are concentrated in the coast landfills in Japan, and generally manufacture in the system of groups. The system of production in a petrochemical complex would be a medium-scale level if it sees worldwide. There is the reason by which this system was generated.

After World War II, capital was insufficient in Japan. Many companies advanced to the oil and petrochemical industry which seemed to have a big future. Small and medium scale factories were constructed. As a result, petrochemical complexes have been formed with the system of groups. They had competed and cooperated at times, and fought for the share with repeating excessive competition.

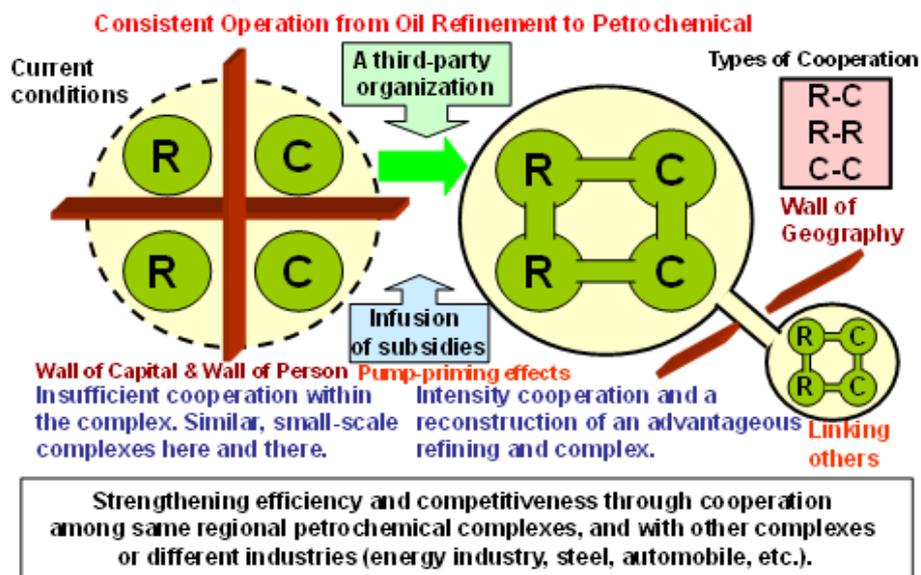
After the defeat of World War II, many oil companies excluding Idemitsu Kosan Co., Ltd. were organized for the supply of crude oil from European and American oil majors. They were devoted to refining oil and selling it only in Japan. Moreover, the oil market in Japan had been defended by restriction of the government. Such a system continued for years. Therefore, domestic oil companies had been aiming at improvement and efficiency of refining capacity. Their concentrating on technological development, cost reduction, and domestic share fought in the same industry had become a main activity. The construction of global competitiveness had been postponed for a while.

However, Provisional Law on Importation of Specific Petroleum Products and Revision of volatile oil sales were abolished in 1996; the self-service gas station was permitted in 1998; and the Petroleum Act Law was abolished in 2001. After repealing these laws, the import liberalization of petroleum product had been taken, and cheap petroleum products had flown in from foreign countries. The sales price had not become the same, and free competition under market mechanism had started. As a result, the movement of industry reorganization had been accelerated.

On the change of oil and chemical industry in the world and domestic deregulation, the reorganization and integration of oil companies was done in Japan. The Nippon Oil group came into existence from a merge of Nippon Oil and Mitsubishi Oil Co., Ltd. and the purchase of Koa Oil Co.² in the refinement section. The megamerger of Nippon Oil Corp. and Japan Energy Corp. is scheduled in 2010. According to the flow of internationalization and deregulation, they carried it out to have global competitiveness. In Japan, oil enterprises have been reorganized and integrated other than mobile Exxon and Idemitsu Kosan Co., Ltd..

In such a severe competitive situation, oil and petrochemical companies came up with the idea of business cooperation in the same region in order to acquire global competitiveness. In this paper, the approach and ways of the high-level integration for group operation in petrochemical complex are analyzed, the meaning of the plan is declared, and the economy that arises from the group operation business is considered. Cooperation with some businesses would be effective for energy conservation and environmental measures, and would advance the possibility to achieve economies of social interests. Also, group operation would break the stoppage and promote innovations of manufacturing technology one after another.

Figure 1 Group Operation in Petrochemical Complex



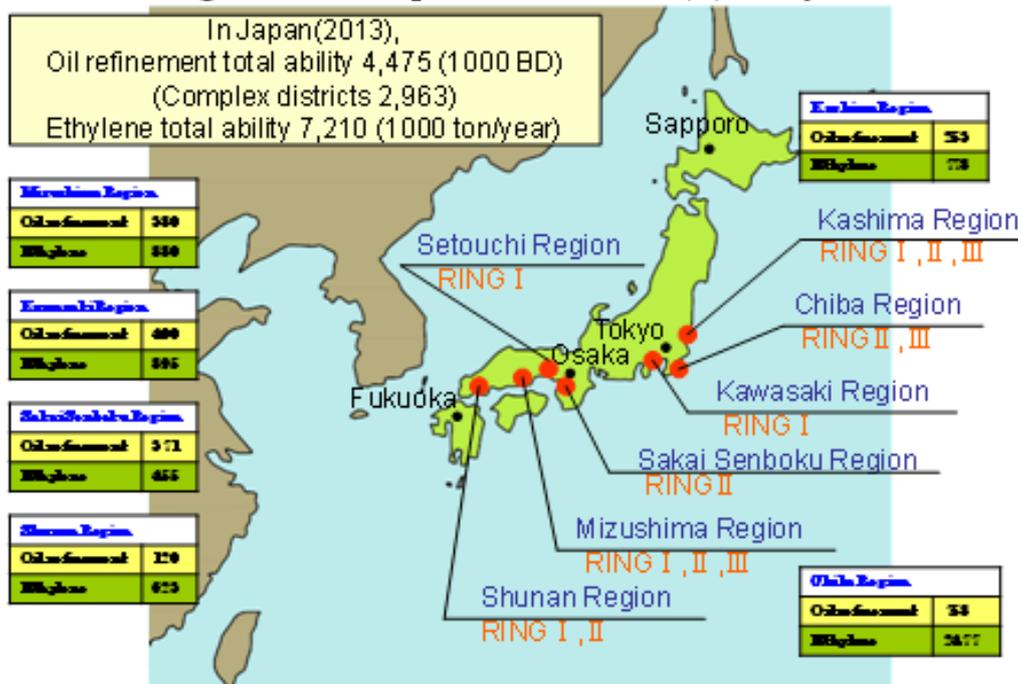
Looking at the technical side, oil and petrochemical companies in Japan had some problems and subjects. These were response to pollution and environmental issues, measures to conserve energy in the two Oil Crises, shift from general-purpose to high value-added product³, and cost reduction. They had dealt with them, and historically developed and accumulated technologies for them. Also, recycling technologies have been developed⁴. Environmental and saving resources technologies of Japanese enterprise have been evaluated throughout the world. These technologies in oil and petrochemical business are especially important.

To solve the problems, 20 companies in oil industry and chemical industry gathered round at first. Under the Research Association of Technology Law, Research Association of Refinery Integration for Group-Operation (RING) was established in 2000. RING has acted group-operation programs in complex, which the Ministry of Economy, Trade and Industry has supported since 2000. In RING projects, they have tried to find new methods of integrated management, exceeding types of business and a frame of capital, developing some latest technologies, aiming at efficiency improvement and optimization. It is important that one complex is thought of as virtual one factory. If it is so, the integrated management could be practiced. As a result, new effects, economies and innovations by new technological development would be achieved. These practices are difficult for one company to do alone.

In RING, the research and development business, related to advanced united management, has been done between different types of business such as oil and petrochemical

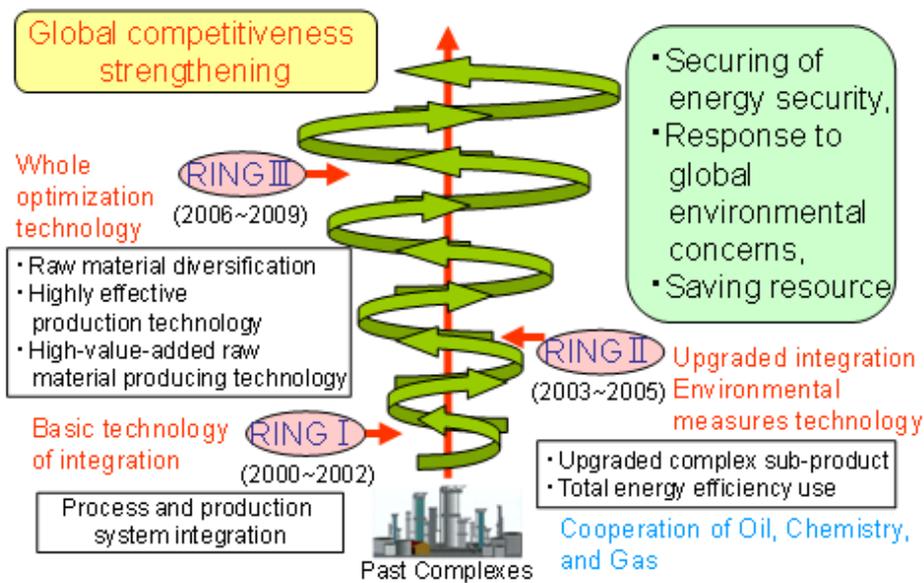
factory, etc. The first R&D project (RING 1) had got good results of the proof of R&D in the each district. It had resulted that strong unity was caused among complex enterprises through these activities. Following this, the second R&D project (RING 2) was executed in 2003. Development of advanced, highly integrated technologies for reducing environmental burdens was performed there. In addition, the action to optimize entire petrochemical complex and carry out advanced function unification was executed in the third R&D project (RING 3) in 2006. At present, such a business has been accomplished in most complexes in Japan, that is, in Kashima, Chiba, Kawasaki, Chita, Sakai Senboku, Mizushima, and Shunan.

Figure2 Development of RING 1,2,3 Projects



One company perhaps tends to attempt single survival and optimization. Even if it notices the importance of cooperation, the priority level might be low. There are only two choices whether to execute it or not in one enterprise. Therefore, the government needs to put out a subsidy at first as a trigger, and it is necessary to establish the third-party institution in order to give the motivation to business cooperation. It is important to build the organization to adjust common interest. The support of the government for RING projects is a pump-priming policy. And the enterprises have recognized new possibilities in business cooperation. They would begin to mix well with them, and come to analyze a system of production with each other. They would examine construction of system of production and technological development accommodating wasted gas, heat, and energy etc. And profits between enterprises, which one company cannot conceive, would begin to be recognized, and their interest would spread various contents such as treatment of waste, contribution to the region, joint power generation etc. Innovations have progressed in an upward spiral through cooperation between enterprises beyond the limit of single company business. The new idea of business cooperation has arisen one after another.

Figure3 The Spiral-up Innovation in Group Operation



ECONOMIES OF COMBINATION

Strengthening cost competitiveness is requested in oil and petrochemical enterprises in Japan. The consolidation and expansion of manufacturing scale, efficiency improvement in manufacturing process, and reduction in cost of manufacturing are more necessary to obtain global competitiveness. To solve the problems, RING was established. The RING project is an attempt of joint operation and business cooperation in oil and petrochemical business. The project assumes current production facilities, capital tie, and business activities. On that assumption, it is necessary for two or more enterprises to cooperate and work on reduction of environmental burdens facing the world. Different from the strategy that one company pursues productivity and efficiency, same kind of effects may be achieved by cooperation between enterprises and different types of business. Whole optimization will be achieved by the system in group operation. And they can implement simultaneously two strategies, Cost Leadership and Product Differentiation.

In addition to economies of scale and economies of scope, some social interests will be pursued. When collaboration with many enterprises is achieved, 'commons' will be necessary for cooperation. Therefore, the aspects to social interest will arise: joint energy use, efficiency improvement, regional contribution, establishment of safety technology, positive commitment to environmental measures, and cooperative treatment of waste etc. And enterprises will pay more attention to practices of social activities: greening of the complex, ownership of joint power generating equipment, security cooperative relationship etc. In this paper, economies of combination is defined as some economic effects which group operation produces; whole optimization and efficiency, simultaneous implementation of two strategies, pursuit of social interests, innovations with group management, management of sustainability. The common integration is defined as the concept of presenting social and economical effects, observed from the development of complexes in Japan, caused by group operation.

Figure4 Concepts of the Common Integration

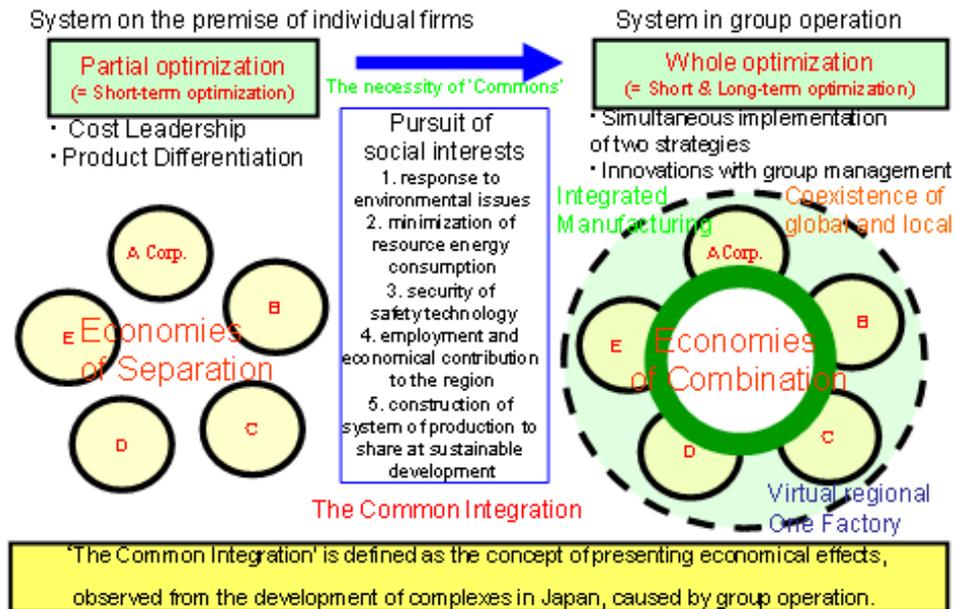


Figure 5 Economies of Combination (Комбинат)

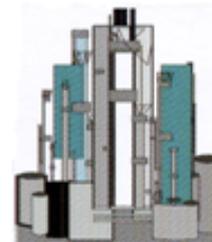
The results of business based on the premise of one company

- Partial optimization and efficiency
- Alternative strategies; Cost Leadership or Product Differentiation

The results of business in cooperation with two or more companies

- Whole optimization and efficiency
- Simultaneous implementation of two strategies
- Pursuit of social interests
- Innovations with group management
- Management of Sustainability

"Kombinat" is a Russian word, means "combination", and is used instead of "complex" in Japan



CONCLUSION

The RING project began from easy business collaborations. It is said that participating companies had not expected the result to joint operation too much at first. However, as RING projects have advanced, most enterprises have come to notice potentiality in the effect of group operation and business cooperation. The circle of RING extends through RING 1, 2, and 3. The speed of technological development in cooperating businesses has increased with acceleration. Innovations have occurred in an upward spiral. And, as time passes, reduction of CO₂, energy conservation, and environmental measures have been paid attention to, and they have been involved in RING projects. If one company does it by itself, only the optimization for one company would be realized. Actions on these problems would be postponed when thinking from the priority level. However, in group operation and business cooperation, these would be problems to undertake first of all.

The goal of the RING project is to obtain global competitiveness in oil and petrochemical companies. When all technological developments are completed, much of reduction of energy use in oil refinement equipment etc. will be achieved, and it will be expected to increase production efficiency by the best flexibility of raw material and semi-finished products between oil refinery plants and different type of factories. And it is forecasted that they greatly contribute to reduction of CO₂ exhaust. As a result of experimental studies that have been done up to now in RING projects, the amount of CO₂ exhaust reduction is expected to reach 500,000 tons/year or more. In addition, the developed technology will be applied to other domestic industrial complexes, and therefore reduce CO₂ further.

Oil and petrochemical companies in Japan come up with the idea of integrated manufacturing to gain global competitiveness. In addition, this way has various effects and the meanings. Especially, there is an important meaning that this would ease control by market mechanism.

The headquarters one-sidedly draw up neither the business plan nor the production plan. Neither the price nor production might be controlled by an international market. The cooperative relationship by group operation is a method of pursuing for such a new economy. It is the management separating system, though businesses are integrated. Various resources would be used by negotiations through the network of the producer, the consumer, the local government, and the resident, etc. It contains the policy of the overall distribution of various resources, the growth rate, investments, the energy consumption, transportations, and the plans of sustainable development and environmental protection. Definite variables of economic activities are systematically decided by the decision making organizations adapting to the level of district, local, national, and international. Detailed plans are decided at each level based on discretion. In the process of all the discussions, the idea of whole optimization will occupy the center of business plans and policies. As a result, the whole optimization is prior to the partial optimization. And social necessities may decide the plans that what and how much they produce. On competition by individual firm and requests of international market, enterprises will be deprived of the authority to make decisions that what and how much they produce. In pursuing the common integration, the decisions can be regularly exercised. In such a meaning, the regional, joint manufacturing body has the right to make decisions of the investment. It is not a top-down type from the headquarters in each company, but a bottom-up type from the

agglomeration of factories in regional zones. In the same way, the price will be set not by decision in headquarters, but the unit cost of production based on inputs from consumers, customer, and regional profit groups etc. However, such a production method doesn't adjust to all industries. This should adjust to the goods, close to the employment and development of regions, such as food, health, medical treatment, medicine manufacture, education, transportation, energy, product necessary for living etc. On the contrary, consumer goods luxury goods etc. should be controlled by market mechanism. The joint production of many interests firms seems to require the complicated and troublesome administration and organization. But the scheme of joint business operation would be used, if the form of administration and organization is constructed once. In doing so, actual complication of interests adjustment could be standardized.

Which system would be superior in the cost and time spent on administration and organization? There might be more wasteful spending in system on the premise of individual firms than system in group operation, when individual firms, which are influenced by market, would be aimed at partial optimization. There is no evidence that the system in group operation would spend in the cost and time more than the system on the premise of individual firms.

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³This had the purpose to evade domestic excessive competition and pursuit of petrochemical manufacturers in East Asian nations.

⁴Kazuya Inaba 'The Upgrade of petrochemical industry by recycling business -Concerning the Case of the Chemical Recycling for Polyester in Teijin Limited-', PROCEEDINGS OF PRESENTATION PAPERS, The 4th International Conference on Innovation & Management, The Organizing Committee of ICIM2007, Yamaguchi University, 2007, pp265-70.