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New Challenge of OR/MS in Asia and Pacific Area

－第27次 國際經營科學會 (TIMS) 基調演說全文－

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Distinguished participants, ladies and gentlemen.

On behalf of Association of Asia-Pacific Operational Research Societies, it is a great pleasure for me to have an opportunity to participate as a plenary speaker in the 27th Conference of TIMS and to exchange ideas with you on the new challenge of Operations Research and Management Science in the Asia and Pacific region. The eminently distinguished gathering here today testifies to the significance and importance of Operations Research and Management Science accorded to the Conference by the people in Asia, Pacific and around the world. This also demonstrates the concept of various socio-economic cooperations in research among nations.

Remarkable Economic Growth of the Pacific Basin Countries

The Pacific Rim is an area of enormous potential and dynamics. The newly industrializing countries, so called NICs, in the Pacific Basin continue to record an impressive growth and this makes them a potentially well-integrated and prosperous regional economy in size and dynamics. In the Pacific Basin, East Asian NICs, in particular, Korea, Taiwan, Hong Kong and Singapore are significant in terms of growth and development. This afternoon, I would like to focus on these East Asian countries out of the various Pacific Basin countries.

East Asia's dynamic growth would not be so distinguished if it were quietly contained and isolated from the rest of the world. The contemporary East Asian region is the one most dependent upon international trade for its livelihood. Japan's international trade account makes the entire economies of many nations seem very small. The Republic of Korea currently stands twelfth in trade in the world. In East Asia, international trade has become a way of life and future growth will depend in many cases upon increasing external contact and trade.

The importance of East Asia has grown more rapidly in many ways than any other region in the past couple of decades and is expected to continue. The traditional focus placed on trans-Atlantic matters has, to a great extent, rapidly shifted to trans-Pacific matters.

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East Asian countries have experienced a much more rapid increase in international trade than western countries, including the U. S. and Canada. Their share of world trade rose from 13 percent in 1970 to 19 percent in 1984, while the share of western countries declined from 70 percent to 61 percent during the same period. Furthermore, the share of trans-Pacific trade to their total increased from 15 percent in 1966 to 24 percent in 1984, while the share of trans-Atlantic trade decreased from 29 percent in 1966 to 21 percent in 1984.

Now, has operations research made any tangible contribution towards problems of development in the past? Will successful economic development provide more desirable environment for the extensive application of operations research in this area? Before trying to give an answer to any of these questions, I would first like to discuss the underlying factors for such an impressive growth in this area.

Growth Factors

There are many factors involved in achieving a certain goal. Although each has its own importance to help get things done, it is difficult to review all of them. I will try to explain several considerably more important ones, here.

I believe that the first factor would be higher education and progressing technology. In Confucianism, it is traditionally believed that having a good education is the best assurance of success in life. This has led to a "Respect-for-Learning" concept in society and competitive educational zeal in many of the East Asian countries.

In college level education, except the United States which has about 5% in college education share to the population, three Western European countries, the U. K., France and West Germany show about a 2 percent average. The East Asian countries of Korea, Japan, Taiwan, Singapore, and Thailand currently show also a 2 percent level. As a result, many East Asian countries including China enjoy a low percentage of illiteracy. This appetite for education has quite naturally made the aquisition and understanding of more advanced industrial technologies easy to become their own. Another factor of successful growth of East Asian countries is the relatively low labor cost and work ethics. During the 1960's, Japan's high quality labor force coupled with low cost compared to the western industrialized countries was one of the most important factors in igniting her industrial development leading to high productivity growth.

Also the work ethic of the labor force is founded on the traditions of Confucian culture. This carries with it a willingness to remain after hours to finish up work, often without extra compensation, to improve skills as much for company as for personal advancement. This sort of work ethics is more or less prevalent in many countries of the region and the relative labor cost advantage coupled with this makes their competitiveness stronger than their rivals.

Third factor is the large investment supported by domestic savings, althouth there are some exceptions. The savings ratio to GNP of most industrialized countries has stood more or less at 20 percent in the past 20 years. By comparison, Japan has maintained the highest domestic savings and investment ratio in the world since the 1960's. Her savings ratio to GNP manintained 30 percent level during the past couple of decades. East Asian NICs also have

shown a quite high ratio, all these countries at around 30% level.

In line with this higher savings ratio, the average annual growth rate of industrial investment also shows a very high level in this region. While the investment growth rate of western industrialized countries stayed at between −2 percent to 2 percent during the period from 1973 to 1983, many of the East Asian countries' stayed more or less at a 10 percent level during the same period.

The fourth factor might be the outward-looking development strategy. This strategy has been pursued by such pipeline economies as Japan, Taiwan, Korea, Singapore and Hong Kong all of which possess relatively poor natural resource bases and yet a high population density.

This strategy, through active international trades, has greatly contributed in expanding the potential markets and quite importantly in localizing foreign technology, and also in enhancing productivity and quality for successful competition in the highly competitive international markets.

Last but not in the least, I would like to argue that an efficient planning system is also an important factor in the economic growth of those countries. This efficient planning system supported by strong political leadership, social homogeneity, and a firm desire for growth enabled East Asia to overcome many obstacles and create success in economic development.

Now, it seems worthwhile for us to briefly review the historic development of operations research in the East Asian region and then look at the prospects for operations research in this area. However, in the absence of relevant information and materials regarding the present status and prospects of operations research activities in other East Asian countries, I am not in a position to elaborate these points for those countries. Hence, if I may, I would like to focus my discussion on the current status and the prospects of Operations Research in Korea.

In the early sixties, the concept of operations research was first brought out quite naturally by Korean military research groups who had a chance to contact the United States army stationed in Korea. In the late sixties, some professors who had been educated in the United States started to teach elementary operations research courses sporadically in the industrial engineering, business and economics department of several major universities. Many English-written operations research texts were used in the class. Some Korean operations research text books had also been published.

Almost all business schools in Korea currdently offer courses under titles like operations research, management science, quantitative management analysis, and quantitative decision analysis. About 70 out of 130 universities and colleges have faculties majoring in operations research or quantitative business analysis and offer operations research oriented courses each year. Relatively small-sized schools do not offer operations research courses but they are also planning to develop them in the near future. This means that the prospects for Operations Research in Korea are bright.

Academic research in operations research is also very active in Korea. The Journal of Korean Operations Research and Management Science Society is published four times each year. Academic work in international journals is also very active. For example, the Management Science and Industrial Engineering departments in the Korea Advanced Institute of Science and

Technology, one of the leading universities in Korea, have 15 faculty members and made 30 publications during 1985 in highly regarded international journals. The number of registered society members is more than 1,000 which is believed to be the second largest among APORS countries.

Research seminars are also active. For example, each of the two OR/MS societies in Korea hosts two conferences a year. In 1979, Korea hosted the Pacific Conference on Operations Research which was one of the seminar activities held in East Asian countries during 1970's. As an academic field, I think operations research has been successfully established in Korea.

Real-world application of operations research started in the sixties in public and private sectors. In the early sixties, military application of operations research started as a formal program in the Ministry of National Defense. Simulation, analytic modelling and cost effectiveness analysis were widely used in weapon systems analysis and in budgeting. In private sector, PERT/CPM technique was first used in the construction of the first large-scale highway from Seoul to Pusan in the 1960's. PERT/CPM is now an essential technique not only in construction but also in many other planning activities in Korea. Other than PERT/CPM, we can also find numerous.

Successful Applicadtions of Operations Research Techniques, Particularly, of Linear Programming

I myself had been involved in applying some mathematical programming models in analyzing and solving the real world decision problems in 1970's. For example, a rather comprehensive dynamic programming model (known as WASP) has been utilized for Korea's long-term electric power sector expansion program. I also directed the interesting study to evaluate the desirable transportation infrastructure for such strategic shipments as sugars, cements dand coal, and also applied an integrated linear programming and dynamic programming model in developing the highway network investment plans.

Even though we have enjoyed some fruitful results from these exercises, the successful application of operations research techniques in real world probems has been very much limited in the past. What are the reasons for this limited application?

One immediate observation is the prevailing lack of understanding the needs and the logics of operations research models on the part of top management and policy makers. In front of the result submitted from the 'black-box' models, which they don't understand, they feel helpless and, even humiliated. They tend to resort to the 'back-of-the-envelop' analysis.

Next structural reason can be found in the inherent charateristics of the organizations typically found in developing countries : that is, those operations do not exhibit the scale merits in justifying the operations research techniques.

Thirdly, I would like to bring your attention to the dynamics and complexities typically found in fast growing open economy like Korea. In dynamically evolving policy environments found in fast changing economy, the private sector as well as the public sector required the continuous innovative and creative strategies and actions much more than the rational and efficient choices

provided such analytic disciplines as operations research.

These structural reasons are further aggravated by the lack of reliable data and the ever widening discrepancies between the theory oriented academic groups and the practice oriented practitioners.

Future Prospects of Operations Research in East Asian Countries

This afternoon, I would like to say that many of these constraining factors disappear quite rapidly in the current and future environment of East Asian countries, particularly in Korea. Time seems to be ripe for an extensive application of operations research in this area, if we consider the following several reasons.

First and above all, I would like to indicate that most of the countries in East Asia have highly educated business managers. Private businesses are undergoing transition of leadership as their founders advance in age. Most of the second-generation successors are college graduates and a large portion of them were educated in Western countries. They understand the need for the quantitative approach. Unlike their founders, they are ready to accept the assistance of operations research in their management decision making.

Secondly, most of the East Asian countries are trying to restructure their economies into more technology-oriented ones. Industries will move towards technology-based and computer-controlled production processes. This trend will lay the ground work for more systematic and quantitative analyses and provide a better environment for operations research.

Next, the economy has been growing very fast in this area and as a result the size of firms is now almost comparable to that of Western countries. It has often been pointed out that in a developing country the size of firms is small and, hence, the marginal benefit from the use of standard operations research techniques will rarely outweigh the opportunity cost. However, an area for possible operations research application is now wide open in countries like Korea and is waiting for the sincere contributions from operations research analysts.

The fourth reason is that the development of computer technology eliminates the problem of shortage of the reliable data necessary for detailed operations research studies. Most of the researchers who have performed operations research projects in developing countries pointed to the shortage of reliable data as one of the most critical factors constraining the applicability of operations research in those countries. Now, the development of microcomputer and computer-based information system expands data processing and retrieval capability which were not available in the past.

I firmly believe that the economic growth of East Asian countries will continue, and that the environment for the application of operations research is much better than in the past. operations research, as a scientific management skill, will be in great demand in this area in the process of technology-oriented and outward-looking development strategy.

To successdfully meet such demands, however, we should develop among ourselves the ability of transplanting the ever developing theoretic capability to the real world applications. This requires on the part of operations research the sincere efforts to acquire the experiences and

insights on particular real world problems under study, rather than attempting mere application of stereotyped ivory tower models and of imported models designed for developed countries.

Councluding Remark

Quite a number of points have been made so far emphasizing certain facts or other. The future prospects of OR/MS in the Asia and Pacific region are very bright. In order to cope with the new challenge in this area, APORS within IFORS was organized in 1985 with 8 member countries, which were Australia, China, Hong Kong, India, Korea, New Zealand and Singapore. Our major concern is how to adapt our reality and culture to solve our challengeable problems through both quantitative and qualitative modelling.

At this time, I am going to close my address, by asking all of you in this field, as the president of APORS, to cooperate with us more closely in the future. Your experience and expertise will be of great help in solving our problems and generate a new way of thinking in the years ahead.

Korea plans to host the first APORS conference in Seoul in August of 1988 on the timely theme of the new challenge of OR/MS in the Asia and Pacific region. Furthermore, the World Olympics will be held in September of the same year. All of yor are cordially invited to both gatherings and also most welcome to an open-minded cooperative gathering for OR/MS as well, for our great hope and future in the Asia and Pacific region.

Thank you.