92国际港口设备及现代化管理技术交流博览会

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认真组织学术交流，

推动港口科技进步。

庄法铭

一九九二年十月

上海港务局局长题词

大力开展学术交流

促进港口技术进步

一九九二，十一月

上海港口协会理事长题词

序

为促进港口技术进步，推动港口事业发展，在举办《'92国际港口设备及现代化管理技术交流博览会》期间，同时举办学术报告会(由我会承办)，邀请国内外港口当局有关领导和工程技术人员以及与港口事业有关的高等院校、科研设计、工矿企业专家、学者作学术报告。得到各有关方面的大力支持，报名前来参加交流的国内外论文达80余篇。经有关专家学者组成的组织评审委员会审定，共录用57篇，汇编出版论文集(中、英文)。主要内容有港口规划与建设、航道工程、港口机械与电气、港口装卸工艺、港口管理、自由港等论文。

全书在论文组织、编辑、出版过程，得到各方面的大力支持和帮助。谨此，表示诚挚的感谢。在论文汇编中如有不当之处，欢迎批评指正。

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目　录

Environmental Protection Projected and Enhanced in the Port of Shanghai

By Tu Deming, Director
of the Port Authority of Shanghai

In the world of today, people are more and more concerned about the environment in which they work and live, and involved in more and more discussions on the issue, which is only natural with the development in economy and industry, yet which puts the questions to people: Is environmental pollution the inevitable result of economic and industrial development? And is economic and industrial development utterly incompatible with environmental protection?

The questions have already been answered as the result of constant improvement of people's understanding, It has been realized that most pollution problems can in fact find solutions through scientific projection and control, even though environmental protection and economic development may seem to be clashing with each other at a glance. To all existing or projected port areas, assessment of environmental impact shall simply mean addressing the following aspects of the issue:

- Quality of water, silt, soil and underground water;
- Natural reserves in the area;
- Dredging and disposal of dredged material;
- Health and safety of port personnel;
- Public welfare of the area; and
- Landscape and entertainment facilities.

Investigation in existing ports tends to identify such problems as: potential enviromental pollution due to lack of appropriate disposal sites for liquid effluents; water contamination caused by undetected harmful substances from operations or accidents; impact of wastes from workshops or parking lots on surface and underground water; etc. Identification of the problems must be followed by packages of mitigative facilities and measures to take possible pollitants and contaminants into control.

Nevertheless, a number of developed as well as developing countries showed a lack of respect for environmental protection during industrial development, and were afterwards compelled to spend several times more of financial resources and efforts tackling consequential problems. The lesson is world-wide. Yet this does not mean that exploitation of natural resources must stop for the sake of environmental protection, which , on the contrary, ought to go hand in hand with economic devlopment. Environmental impact shall be carefully and thoroughly studied and appropriate mitigative measures and strategies worked out in the stage when proposed development is projected, which will ensure that project development and terminal operation be

carried out with the minimum environmental impact. It is my belief that environmental projection and economic planning are inseparable, that long-term economic growth depends on a sound environment, and that exploitation of resources must take environmental protection strategies into account, so that it will not imperil the resources for the future generations. Such is the importance of environmental projection to economic planning, and to port planning as well.

The Port of Shanghai has been paying high respect for encironmental protection. The port authority has set up a Port Environmental Protection Bureau to take charge of environmentai protection programs in port areas, and Environmental Monitoring & Protection Centers specializing in the treatment of environmental pollutants and contaminants. At present, environmental pollution in the port areas is under control and the quality of environment is apparently improving.

Over the past decade, port planning of the Port of Shanghai has always been incorporating environmental projection in both the remodeling of existing port areas and the construction of projected new ones, with the government's environmental guidelines being strictly followed. Examples are the Wujing Stevedoring and Warehousing Company, the Baoshan Container Terminal and the Zhujiamen Coal Terminal constructed during the 7th Five-year Plan and a number of old port areas remodeled, for which environmental inpact assessment was conducted before project engineering in relation to the choice of port sites, flow and composition of cargo, technology and equipment for cargo handling, treatment of effluents and mitigative measures, etc. In the initial stage of the projects, adequate consideration was given to the optimization of terminal layout, cargo handling function and schemes for the treatment of effluents. Environmental impact assessment has also been conducted for the Waigaoqiao marginal berths under construction and the projected Luojing Coal Terminal during the 8th Five-year Plan, both reviewed and approved by the National Environmental Protection Bureau.

Moreover, the functional restructuring of the existing Huangpu river terminals carried out by the Port of Shanghai in line with the Municipal Master Layout Plan and the needs for the opening and development of Pudong also takes into account the requirements of environmental protection. For instance, it has been decided that the size of coal carriers shall be restricted entering the river, old equipment be replaced in steps by equipment that has less environmental impact (e.g. bucket/chain unloaders), and additional mitigative measures be taken against dust and other pollutants at the Coal Handling Company so as to provide a better residential environment for the neighbourhood, minimize impact of coat handling on the Huangpu river, and improve the landscape in the vicinity of the Nanpu Bridge. The projected Luojing Coal Terminal will take over coal traffic now using the river terminal, and the traffic of metal ores now handled by the Xinhua Stevedoring Company will move to Luojing, too. The new port areas shall all resort to modern environmental protection measures to minimize the impact of port operations on the environment.

In order to improve the environment along the Bund, the port authority is to give over a few kilometers' length of waterfront to the city for greenery and tourist entertainments, which will increase the length of waterfront for such purposes to 9.2

kilometers, accounting for 7.7 % of the total length of the river shoreline.

However, the port still has a fairly long way to go to meet the state regulations and requirements in such aspects as acquatic impact of liquid effluents and solid wastes from ships, air pollution by dust from dry bulk handling, water contamination by oily dicharges, noise impact of machinery and equipment, inadequacy of space for greenery on the terminals, etc.

In comparison with other Chinese ports and ports in developed countries the Port of Shanghai yet leaves much to be improved in environmental aspects.

To enhance the level of environmental protection, the port shall, on top of what has been achieved, make improvements by taking the following steps:

1. Promoting port personnel's awareness of environmental protection and fostering the consciousness that economic construction and environmental protection are an integrated whole;

2. Intensifying the function of environmental protection management and replenishing the job with additional technical staff;

3. Making concentrated studies on the mitigation of environmental impact to attain a higher level of accomplishment, improving the management of environmental protection facilities for greater effectiveness, and replacing or renoveting such facilities as are obsolete, low in efficiency and inadequate in capacity to ensure the good results of environmental protection;

4. Making a rule of retrospective assessment of environmental impact in the projects of remodeling old port areas and constructing new ones, which, after completion and commencement of opration, shall be subject to regular retrospective assessment of environmental protection and checked against the targets set in the environmental impact assessment. Other projects shall be requlary reviewed too to see whether the projected results are achieved.

5. Adopting modern means to improve environmental projection and enhance the power of quatitative analysis of environmental impact in the stage of projection;

6. Maintaining a consciousness of macro- environment while conducting port planning and port construction so as to keep environmental impact of port construcition to the minimum; and

7. Seeking financial assistsnce from the national and municipal governments in major environmental protection facility investments in the port, which constitutes part of the infrastructure facilities of national economy and whose economic benefits are largely incorporated into those of both national and local economies.

Technological Progress and the Port's Economic Benefits

By Wang Shaomei and Bi Hualin of
Wuhan Water Transport Engineering Institute

Great success has been achieved in ports in the past 12 years of economic reform in China. The purpose of the reform is to increase the vitality of enterprises and raise their productivity, changing the focal point of production and development from speed to efficiency. Productivity as is discussed here does not simply mean labour productivity; it refers to the total productivity that involves all factors such as labour, capital, etc. Only when productivity is raised can the economic benefits of an enterprise be ensured, Generally, expansion of production depends on the three factors of increasing labourforce, adding to investment and making technological progress. And only when production is expanded by means of technological progress, will an enterprise attain its intrinsic development and raise its economic benefits. Therefore, of practical importance are studies on the relationships between technological progress and economic benefits of the port, and assessment and evaluation of the conditions of the former and its influence on economic growth. This paper starts by analyzing the significance of technological progress in the port to make a preliminary study on the technological progress and economic benefits as well as methods used for the assessment and evaluation of technological conditions and economic results, by using the case history of some ports.

I. Economic significance of technological progress of the port.

As an important link in the transportation chain, the port serves industry, agriculture and people's daily life. Hence, technological progress in the port is a process of development and perfection of the technology of production, management and service. Besides improvement of equipment and cargo handling technology, it involves improvement of the workers' skill, the level of organization and management and quality of service as well as reduction in the consumption of manpower, energy and materials.

A great change that has taken place in Chinese ports since 1949 is mechnization, the use of machines to replace manpower. This represented a popular form of technological progress, i.e., the increase in the number of machines which do the workin place of hauman beings. Since the 1st Five-Year Plan (1953-58), labour productivity has been rising with the increase in equipment. Take a port in South China for example. During the 1st Five-Year Plan, the labour equipment index (or the index of productive fixed assests per man, expressed in yuan/per man) increased progressively by 11.7% per year and labour productivity expressed in physical output and the output of productive fixed assets increased by 13.5% and 11.1% respectively every year. The economic effects were remarkable. But, in the whole period of 35 years (1953-88), although the equipment index and labour productivity went up by 7.47 and 3 times

respectively, output of productive fixed assets showed an downturn except during the 1st Five-Year Plan and the years of economic adjustment between 1963-1965. Return on investment was at a standstill. Statistics and results of the total productivity model show that, during the 1st Five-Year Plan, total productivity rose by 41% ,of which 36 % was due to capital investment, while during the whole 35 years between 1953 and 1988, total productivity rose by 85% and 62% was due to capital investment. Similar results are found in other ports. All this demonstrates that, in the past, the development of the port was basically extrinsic, mainly depending on the increase of technical equipment, in the amount of means of production per labourer, so that efficiency was improved by replacing manpower with machines. This is an inevitable course for every country at its initial stage of industrial development, and indeed, the economic benefits brought about are remarkable. However, the effects of such quantative technical progress are limited. When productivity can no more be raised by increasing the means of production, another form of technological progress, i.e., the qualitative progress will prove to be particularly important. This means that, to further raise productivity, it is essential to use equipment of high efficiency and low energy consumption, increase the availability and output of the equipment, raise the educational and technical level of the workers, and adopt modern means of organization and management of production. Technological progress in this broad sense provides an unlimited prospect for economic development, while productivity raised by increasing the quantity of input is limited.

Although investment is also needed for technological reform, introduction of new technology, and training of the workers, this kind of investment are much more effective in promoting economic growth than the simple increase of the means of production. The Port of Yichang, for example, made great efforts to promote technological progress by: renewing equipment and updating technology in cooperation with colleges and institutes to increase production, such as the introduction of continuous bucket unloaders which to replace grabs in unloading vessels; using computers in financial management, and calling on mass participation in the technical reform, which resulted in 350 constructive proposals in 1990 and 73 successful innovations. In all this the port made an investment of RMB 3 million Yuan in 1991, which brought about a return of RMB 47 million Yuan through increasing profits and saving costs by means of technological progress. The economic effects were remarkable. Just as Carl Marx put it, with the development of large industries, the creative power for real wealth depends relatively less on the time and quantity of labour consumed than on the motivation and dynamics mobilized during the labour hours, yet the motivation itself, as well as its great efficiency, is disproportimate with the time spent directly on its generation; rather, it depends on the general scientific level and technological progress, or in other words, in the role of science in production.

II. Evaluation of technological progress in the port.

Continuous researches have been carried out by economists on the analysis of technological progress and evaluation of its results alongside with studies on productivity engineering, since the country began to make reforms and open its door,

in order to establish systematic criteria for the evaluation of technological progress in an enterprise which suit Chinese specific conditions, so that the effects of technological progress on the development of an enterprise and its various departments shall be assessed quantitatively rather than qualititatively. Up to now, many problems remain to be solved both in theoretical studies and practical applications. As port operation, which is more or less a random practice, is fairly different from industrial manufacturing and mining, a great part of industrial criteria for general purposes are not applicable in the port, whose output is largely restrained by external conditions, mainly cargo flows. Besides, as port operation involves large investment, long construction time and consideration for social welfare, criteria for the port must be simple and easy to apply, reflective of real conditions and possible for making comparisons. In line with the items used at the moment in economic statistics, the following points are proposed for the evaluation of technological progress in the port:

1. Annual progress rate a (%).

From the production function $Q=A(t)\cdot K^{\alpha}\cdot L^{\beta}$, it can be conducted that $a=q-ak-\beta 1$, in which Q is the production output while K and L respectively capital and labour inputs, and α and β respectively elasticity of capital and labour inputs. It is assumed that the reward in scale is fixed, then $\alpha+\beta=1$. When A(t) is a function of time, an coefficient of the rate of technological progress, and k and 1 respectively the annual growth rate of capital and labour inputs, q is the annual growth rate of production output.

2. Technological level of the year in question At.

This reflects the difference in technological conditions between the beginning and end of the year in question. It is based on the annual progress rate of the year:

$$At \begin{cases} 1 & (t=0) \\ (1+a)^{t} & (t>0) \end{cases}$$

3. Labour productivity.
4. Profit and tax on capital.
5. Energy consumption.
6. Technological equipment (productive fixed assets per person in Yuan/person).
7. Proportion of technical and managerial personnel.
8. Proportion of investment for equipment renewal and technical innovation T.

$$T=Kt/Kp.$$

in which Kt is investment for renewal and Kp the original value of productive fixed assets.

9. Ships' dwell time in the port.

To evaluate the effects of technological progress on the port's economic benefits, the following three indexes are helpful:

1. Contribution of technological progress to the growth of output Ea(%), $Ea=a/qX100\%$.
2. Contribution of capital investment to the growth of output Ex(%), $Ek=a\cdot k/qX100\%$.
3. Contribution of labour input to the growth of output Ee(%), $Ee=\beta\cdot 1/qX100\%$.

III. Case studies.

Based on the above-mentioned indexes and recorded statistics, quantitative analysis is made of the production growth of 4 Chinese ports during the 10 years betwenn 1980 and 1989 in the following steps:

1. Sort out the data.

When the indexes are obtained, different economic measurements will bring about different results. In ports, the output is measured in throuhgput volume, which amounts to output in labour productivity. It is somewhat illogical to have the number of passengers included in the throughput volume, but the former accounts for a very small proportion of the latter. Capital input is obtained by adding the average quota of circulation capital to the original productive fixed assets. And labour input counts in all personnel on the payroll at the end of the year.

2. Determine the values.

The elasticity values of output α and β ought to range between 0 and 1, of which the value a is estimated between 0.3 and 0.7 in most countries. Generally speaking, as China is rich in labour resources and short of funds, production growth rate resulting from increase in capital input ought to be higher than that from the increase of labour input. But the port is different. It involves large investment, long construction time and consideration for social welfares. As a result, the utility of equipment is generally low, causing a low value of α, which is made to vary between 0.1 and 0.9. The values of q, k and 1 for each port are obtained by means of geometric average, and every determined value of α is tentatively computed with software packages 1 and 2 to find the group of values α, β and a with the minimum differences. It has been proved through calculation that the value a varies from port to port between 0.14 and 0.68. When the value α、 β and a are determined for each port, computations can be made on the basis of the statistics of different ports, the results of which are shown in Table 1.

Port	Growth rate of Labour Productvrity (%)	Growth rate of Output (%)	a (%)	At (At=1 for 1980)	Contribution to Output Growth (%)			
					Ea	Ei	Ek	Total
A	11.5	9.4	7.37	1.8965	78.58	11.13	10.29	100
B	4.4	4.68	0.28	1.0255	5.99	0.66	93.35	100
C	3.3	6.62	2.67	1.2676	39.96	44.59	15.45	100
D	5.2	8.32	4.12	1.4382	48.29	39.20	12.51	100

Table 1: Results Calculated of Technological Progress in Ports

3. Interprete the results.

The results in Table 1 show that the average technological level in all ports was raised during the year between 1980 and 1989, and so was the contribution of technological progress to production output. However, the level of progress varies from port to port. When ports A and B are both inland river ports, port A was relatively weak in equipment and facilities, and its technological level of the starting year low and funds lacking. Its annual capital input increase was only 1.38% from 1981 to 1989, mainly in equipment renewal and innovation, its proportion T being 10% ~ 15%. The

rate of its annual technological progress was 7.3%, with a total rise in its technological level of 89% over the 9 years. The average annual growth of output was 9.4%, and that of labour productivity 11.5%. Contribution of technological progress to output increase accounted for 78%, and the port's economic benefits were remarkable. But port B was relatively better than port A in equipment and facilities. Its annual investment was increased by 6.4% on the average, but its proportion T was 3.5～5.6%, and the rate of technological progress was 2.5%, which was obviously lower than that of port A. The port's annual output increase over the period was 4.68%, and its average labour productivity growth 4.4%. Accordingly, contribution of technological progress to output in this port was small.

Ports C and D are both sea ports, whose infrastructure and facilities are more advanced with more funds from the government than the inland river ports. The average capital input in port C grew by 9.18%, and port D by 10.68%, yet their annual outputs increased by 6.6% and 3% respectively. Their values of T varied between 1.1% and 4.3%, lower than that of port A, and contribution of technological progress to output growth was smaller. On top of many other reasons, the main reason that restricted the effects of capital input growth on the increase of economic benefits was the high base economic index of 1980 of the sea ports.

The results shown in Table 1 basically reflect the effect of technological progress on product growth. Contribution of technological progress to output increase is basically in line with the rise of technological level, which proves that technological progress has certain effects on the growth of production and improvement of efficiency in the port, and that output increase in the port over the years was mainly the result of increase of input. The development of ports has been extrinsic. In order to further raise productivity, it is essential to promote technological progress and make more efforts in equipment renewal and technological innovation, with emphasis laid on the quality of inputs.

Quantitative analysis and evaluation of the technological and economic conditions in the port, and studies on its productivity, technological level and proportion of contribution of technological progress to output, are of practical significance to the effective organization of all inputs for the increase of economic benefits of the port. However, owing to the special nature of port operation, the number of factors bearing on its output, and the difficulties in information collection, studies in the problem become all the more complicated. This paper merely makes a preliminary study, by using the case history of a few ports, of problems which are open to further discussion.

The Bonded Zone of the Port of Tianjin
— An Important Gateway Open to the World

By Zhu Qingyuan and Lu Dianzhong of
the Management Council of the Bonded Zone of the Port of Tianjin

On May 22, 1991, the State Council approved the establishment of the Bonded Zone of the Port of Tianjin, which set up a new gateway for the country to open its door to the outside world.

The Bonded Zone, located in the centre of all the ports on the Bohai Sea in North China, shall play an important role in the promotion of both regional economy and foreign trade.

I. Objectives and superior conditions.

A bonded zone is a designated area operated in accordance with international conventions and similar in nature to a free trade zone, a zone detached from customs control of a country where commodities from other countries are allowed to import and export duty- free. The objectives in establishing the Bonded Zone of the Port of Tianjin is to create a perfect investment and operations environment to attract both domestic and foreign organizations engaging in international trade and businesses dealing with warehousing, transport, packaging and processing of goods for export, so as to serve the expansion of international trade and entrepot trade as well as the increase in the amount of transit goods and goods processed for export, in order that it will eventually develop into a free trade zone typical of China which is closely linked to the international trade.

The Bonded Zone, located in the center of the Tanggu New Port Area of Tianjin, now has an enclosed area of 1.2 square kilometres, projected to be expanded to a total of 7.1 square kilometres. With its favourable economic and geographic location and the port at its back, the Bonded Zone is endowed with a number of superior conditions.

Tianjin, the gateway of China's capital, is one of the three municipalitities directly under the Chinese Central Government. Historically it was a busy trading and financial centre in North China. Great changes have taken place since the reform and open-door policy was declared 10 years ago. The city is all functional and equipped with good facilities for commerce, finance, customs, commodities inspection, and daily living. It is a well-known port city. It is not only an outlet to the sea for provinces in North and Northwest China, but also the nearest city to the starting point of the continental land bridge between Northeast Asia and Europe. This unique geographic location determines the strategic position of the city as the focus of both internal and external economic prosperity.

With its good reputation in the world, a wide connection with international