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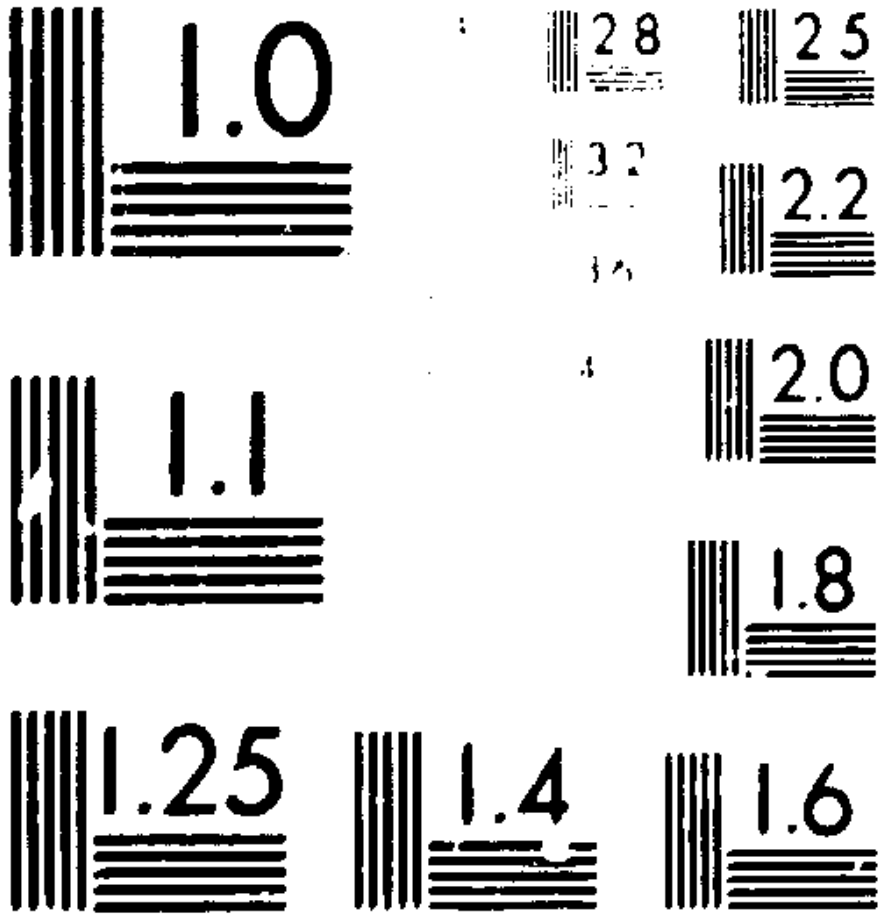

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DP/ID/SER.A/419
14 January 1982
English

ASSISTANCE TO MACHINE BUILDING INDUSTRY

DP/CPR/79/021

CHINA

Technical report: Instruction and guidance in Handling of Materials at the Central Institute of Plant Design *

Prepared for the Government of China
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Richard Muther,
expert in the handling of materials

United Nations Industrial Development Organization
Vienna

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EXHIBITS AND APPENDICES

Note that Appendix III is prepared as a section that can stand alone as an article for publication. It covers some of the same points made in Appendix II but addresses different potential readers. Still, I would hope that the Central Institute and Ministry of Machine Building Industries will consider the suggestions made in both appendices.

INTRODUCTION

This report covers a two-part mission, of 13 weeks:

Phase One - 14 February 1982 to 28 March, including travel.

Phase Two - 02 July 1982 to 17 August, including travel.

> Actual working days on location were 39 plus 41, or 80 days, minus 10 Sundays = 70. Travel, report preparation...added 8 more days. Extensive preparation time is not included in the above. Note: Because expert, prior to this mission, was already highly experienced and had been in China previously on another non-UNIDO mission, briefing in Beijing instead of Vienna allowed extra time on location for the benefit of the client.

Host Organization

The Central Institute of Plant Design and Research, of the Ministry of Machine Building Industry, 227 Wangfujing Street, Beijing, P.R. of China.

- Primary Coordinator: DING Chong-gao
  Director, Technical Division
- Interpreter: YIN Jia-He
  Senior Engineer, Technical Division
- Coordinator: ZHANG Lin
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Consultant/Expert

- Richard MUTHER, PE, CMC
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UN Development Programme in China

. Mission Coordinator:
Albertus W. SISSINGH
Senior Industrial Development Field Advisor

. Initial Briefing:
Kerstin LEITNER
Assistant Resident Representative

. UNDP Program Section:
Mme LI Qi-ming
Programme Officer

Note:

The opinions expressed in this report are those of the writer (the expert/consultant for the project/ mission) and do not reflect the opinions of the United Nations Industrial Development Organization or UN Development Programme in China.

PURPOSE

The purpose of this report is to explain what was covered by the UNIDO expert/consultant and to supply suggestions for the future to both UNIDO and the Central Institute for Plant Design and Research.

The purpose of the project/mission was "to assist the country to strengthen its machine-building industry by improving the quality of its products, the efficiency with which they are produced and the working conditions in industry".

Specifically, the project/mission is described in UNIDO Job Description DP/CPR/79/021/11-18/31.9.B. This emphasizes:

1. Technical guidance on factory layout and materials handling.
2. Training local personnel in materials-handling techniques.
3. Giving lectures on modern methods of materials handling, flow of materials analysis, and plant planning.
4. Giving guidance and advice at specific factories chosen as case studies.

PROGRAM--PHASE ONE

Phase One of the project/mission included six parts:

1. Four full weeks of training of 34 experienced engineers from many places in China--(40 classroom hours per week).
2. Five visits to two cooperating plants by enrollees, with specific assignments for each visit under the direction of the expert/consultant.

3. Three half-day special lectures for 200-plus invited managers of industry and officials of other agencies, to emphasize the vital importance of materials handling and how to improve existing handling methods.

4. Surveys by the expert at each of two cooperating plants with specific suggestions for improvement.

5. Identifying 13 specific projects for enrollees to work on during absence of the expert (between the two phases of the overall mission); guidance in making a project schedule for each project; organizing plans for second part of expert's mission.

   The program was extremely full and both the expert and interpreter had to call a halt from Sunday activities to catch their breaths.

6. Outlining a two-week training program for Chinese industry in materials handling and materials handling analysis.

For specific Diary of Activities of expert/consultant during Phase One, see Exhibit 1.

For specific Activities with Cooperating Companies in Beijing, see Exhibit 2.

ACCOMPLISHMENTS - PHASE ONE

The overall program for this first part of the mission has to rate "excellent" from all viewpoints.

1. The Institute was outstandingly helpful; it prepared extensive translated material; and its interpreter was unusually competent--technically, language-wise and personally.

2. The two cooperating plants were convenient and truly cooperative.

3. The expert was experienced with many prior foreign training-consulting projects and was flexible enough to cope with unanticipated situations, having to take the lead in many cases.

4. The content of the program was full, pertinent and meaningful, well presented and well received.

5. Some thirty-four enrollees were exposed to, and had opportunity to apply, proven technology of materials-handling analysis.

6. Numerous suggestions for improvements in handling methods resulted from the sessions at the cooperating plants.

7. Some 200-plus industrial managers and industrial planners from various agencies were provided a new appreciation of, and respect for, materials handling and its potential in reducing operating costs.

8. A two-week course in materials handling for Chinese industries was planned and its content outlined.

I hardly think more could have been accomplished. Certainly, the Institute received more than it could have expected. This first part of the mission alone will have an important impact on advancing industrial material handling in China.

PROGRAM - PHASE TWO

Phase two of the project/mission included the following parts:

1. Eight days of project analysis of 14 points done by enrollees (13 at the cooperating plants, plus one Institute project). These involved presentation by enrollees with comments, critiques, and further considerations and additional improvements suggested by the expert/consultant.

2. Display/exhibition of 13 projects done by enrollees with invitations extended to the cooperating companies and to other institutes and agencies.

3. Specific review by expert/consultant of the new two-week course for China in materials handling--the one outlined in Phase One. Additionally, a prepared outline for two one-week courses in Chinese on Layout Planning and Systematic Planning of Industrial Facilities, were developed.

4. Review and response to questions by enrollees on previously presented materials--chiefly handling analysis and layout planning--for the same 34 enrollees as in Phase One.

5. Slides and display of specific reports done by western consultants and literature on recent developments in materials handling equipment.

6. Three weeks of training of 34 engineering enrollees on Systematic Storage Planning, Systematic Planning of Industrial Facilities, and Long Range Planning of Industrial Facilities.

7. Consulting visits with suggestions for improvements by expert/consultant at four additional plants--two in Shanghai and two in Hangzhou.

8. Two day-long lecture series on materials handling opportunities. These were to audiences of 100-plus engineers from companies and planning institutes. Each was under the sponsorship of the Shanghai Institute of Plant Design or Second Institute of Plant Design (Hangzhou).

9. A final examination was prepared and given. All enrollees (but one, who had to leave because of illness in his family) passed. A certificate is to be issued to each enrollee.

For specific Diary of Activities of expert/consultant during Phase Two, see Exhibit 3.

For specific companies consulted with in Shanghai and Hangzhou, see Exhibit 4.

ACCOMPLISHMENTS - PHASE TWO

The overall accomplishments for this second part would appear to be enormous.

1. China now has at least 34 engineers from several areas of the country, who understand and generally can apply the basic techniques of SHA, SLP and SPIF. These techniques are generally reocgnized as the most effective systems of industrial facilities planning available anywhere.

2. Some five hundred related persons have been exposed to at least 6½ hours of explanation of the importance of materials handling to their costs, of the necessity to plan an integrated handling-and-layout facility, of the fundamentals of planning such facilities, and of the knowledge that there are systematic ways to solve these problems.

3. Six plants--or at least selected members of their staffs--have been exposed to new opportunities for improving the materials-handling methods and for future planning of their facilities, and they have been given specific suggestions for improvement.

4. The Machine Building Ministry has a sound, organized course on materials handling and M.H. analysis. of two weeks in length, available to present, in Chinese language, all over the country.

5. It has also two one-week courses outlined and available with further preparation, on Layout Planning and Systematic Planning of Industrial Facilities.

6. Attention has been drawn to the need for planning of materials-handling installations by three articles in the press.

   . Front page of Ji Xie Zhou Bao (April 16) (Machinery Weekly Newspaper). See Exhibit 5.

. Second page of China Daily (July 31) (English-language Newspaper). See Exhibit 6.

. Article--"An American Planner of Industrial Facilities Looks at Chinese Manufacturing", scheduled to appear soon in organ of the Ministry of Machine Building Industry. (See Appendix III.

7. Several members of the Central Institute of Plant Design & Research and other allied institutes have a broader view of facilities planning and the important affect that lack of long-range site planning has on high materials-handling costs.

8. Similarly, more than 500 planners from industrial companies and planning institutes now recognize that--at least in Western eyes--there is a correlation between product quality and plant housekeeping. I believe this is a basic problem for Chinese industry.

SUMMARY

A 13-week project--split into two phases--was conducted in February-March and July-August 1982.

The purpose was to help Chinese industry improve its operations. Specifically, this involved training of 34 experienced engineers in modern ways of analyzing materials-handling problems. In addition, the mission taught these enrollees the techniques of industrial space planning at micro and macro levels and of long-range planning of industrial facilities.

A two-week course on materials handling for presentation throughout China was developed.

Six plants were provided with consulting advice regarding their handling and facilities problems.

Thirteen projects of at least two man-weeks each were conducted, critiqued by the expert/consultant, and presented to management.

Over 60 specific suggestions were made to industrial companies and some 500-plus engineers/planners of Chinese industry were exposed to the need for more and better analysis of materials-handling methods.

EXPERT'S CONCLUSION

I think all who related to this project/mission agree that it could hardly have been done better and that the results will be far-reaching.

Note further that an extensive summary--written as a magazine article for the benefit primarily or the Central Institute, the Ministry of Machine Building Industry, and Chinese Manufacturing plants--is included as Appendix III.

Please note that further comments or suggestions--primarily for the benefit of UNIDO--are included as Appendix I.

RICHARD MUTHER & ASSOCIATES, INC.
Richard Muther, PE, CMC, President
23 August 1982

EXHIBIT 1

DIARY OF MATERIALS HANDLING MISSION TO CHINA

1. Sun. 14 Feb. — Depart Kansas City; Stopover in San Francisco
   Mon. 15 " — SFO to Tokyo; Overnight in Tokyo
   Tues/Wed 16/17 Feb. — Tokyo to Peking; Arrangements at Institute
   Th. 18 Feb — Visit UN (briefing) & bank for money; Discuss plans, program, arrangements
   Fri. 19 Feb — Visit Machine Tool Plant; meet enrollees
   Sat. 20 " — Visit I.C. Engine Plant; Work up plan for cooperating plants
2. Sun. 21 Feb. — Forbidden City...
   Mon. 22 " — Arranging materials; Discussion with Xing Hua Engrg./Consulting Corp.
   Tues. 23 " — T* - Assignment re Equivalent Intensity & Equivalent Distance
   Wed. 24 " — T - Open officially--Day 1 of SHA
   Th. 25 Feb. — T - Work at cooperating plants--Survey and M.H. Committe workup
   Fri. 26 Feb. — T - SHA-"Day 1" continued
   Sat. 27 Feb.— T - " into Day 2 (Friendship Store; Opera)
3. Sun. 28 Feb. — Great Wall & Ming Tombs
   Mon. 1 Mar. — T - SHA Analysis of Material Flow; Diagraming
   Tues. 2 Mar. — T - Diagraming & Interpretation
   Wed. 3 Mar. — T - Selecting M.H. equipment
   Th. 4 Mar. — Work at cooperating plants
   Fri. 5 Mar. — T-Review Work Sampling results; SHA steps 5,6,7; Heater Production Problem Phase II
   Sat. 6 Mar. — T - Evaluating Alternative M.H. Plans; Question & Answer afternoon; Large-room check out
4. Sun. 7 Mar. — Temple of Heaven; Outline three special major talks
   Mon. 8 Mar. — T - Detail Handling Plans. External Integration; Installation
   Tues. 9 Mar. — T - Heater Production Co. problem (Detail Handling); Simplified SLP
   Wed. 10 Mar. — T - Full SLP--Flow of materials analysis
   Th. 11 Mar. — Work at cooperating plants; Prepare for special talks
   Fri. 12 Mar. — T - Combining relationships; Diagraming and developing space requirements
   Sat. 13 Mar. — T - Detail Layoug Planning; Problem; Phases & Installation; Prepare for special talks
5. Sun. 14 Mar. — Summer Palace; Fragrant Hills; 500 monks++
   Mon. 15 Mar. — T - Integrating SLP & SHA
   Tues.16 Mar. — T - Integrating problem; Ash Machine Tool Co.--Case example, Phases I & II; Identify & define projects for enrollees.
   Wed. 17 Mar. — T - Ash Machine Tool Co.--Problem, Phases III & IV; I.C. Engines Ltd.--Case example
   Th. 18 Mar. — Work at cooperating plants; Plans for next visit
   Fri. 19 Mar. — T - I.C. Engines Ltd.--Case example continued. How to manage planning projects
   Sat. 20 Mar. — T - Line up and review project schedules for 13 in-plant projects
6. Sun. 21 Mar. — Prepare for special major talks
   Mon. 22 Mar. — Met with enrollees for question & answer discussion; Presentation to 250+ special guests of the Institute on M.H. Basics and importance of/need for M.H.
   Tues. 23 Mar.— Reports to Machine Tool Plant by enrollees and R. Muther; Presentation to special guests of the Institute on Underlying Cost Factors and Not-so Obvious Realities of M.H.
   Wed. 24 Mar. — Reports to Internal Combustion Engine Plant by enrollees and R. Muther; Presentation to special guests of the Institute on How to Analyze M.H. Problems
   Th. 25 Mar. — Met with Mr. Sissingh re program and plans. Met with Ding et al re next tour plans. Goodbye luncheon. Projects reviewed.
   Fri. 26 Mar. — Pack & Departure

* "T" indicates training day of 7 classroom hours each.

EXHIBIT 2

ACTIVITIES WITH COOPERATING PLANTS IN BEIJING

19 Feb.	- Visit to each plant by all enrollees.
19 & 20 Feb.	- Visit to each plant by expert/consultant.
25 Feb.	- M.H. Survey by enrollees (half of them at each plant); arrangements for M.H. Committee at each plant (by expert/consultant).
4 Mar.	- Initial work-sampling trial studies by enrollees (half at each plant); initial M.H. Committee meeting at each plant; survey of assembly areas at each plant by expert.
11 Mar.	- Work-sampling studies by enrollees (half at each plant); second meeting of M.H. Committee at each plant (Identifying opportunities for M.H. improvements); Survey of storage areas at each plant by expert.
18 Mar.	- Second set of work-sampling studies at each plant; Third meeting of M.H. Committee at each plant (Selecting specific plans for improvement); Survey of primary operations (metal forming and machining) at each plant.
23 & 24 Mar.	- Reports to cooperating plants by enrollees and expert/consultant; including preliminary selection of larger projects to be done between the phases of expert's mission.

EXHIBIT 3
Page 1 of 2

DIARY OF MATERIALS HANDLING MISSION TO CHINA
2nd Phase of 2-Part Assignment

1. Fri. 2 Jul. — Depart Boulder, CO, for San Francisco; Overnight with brother-in-law.
   Sat/Sun 3/4 Jul. — Depart SFO for Tokyo; Overnight in Tokyo.
2. Mon. 5 Jul. — Tokyo to Beijing; Arrangements & planning.
   Tues. 6 Jul. — Briefing at UNDP; Bank; Greet enrollees; Unpack training materials.
   Wed. 7 Jul. — New M.H. Course planning; Critique two projects.
   Th. 8 Jul. — T* - Two projects critiques; UNDP & bank (second trip); Meeting with Mr. Sloan of British Traders group and Institute's staff.
   Fri. 9 Jul. — T - Critique three projects
   Sat. 10 Jul. — T - Critique two projects; Review Work Sampling
3. Mon. 12 Jul. — T - SHA examination; From-To Chart explanation; critique two projects.
   Tues. 13 Jul. — T - SLP examination; Discussion of two exams; Demonstration of Rel. Chart diagraming; Critique of one major project; Demonstration preparation
   Wed. 14 Jul. — T - Critiquing Institute's engine-plant project; Calculating requirements Return investment; Detail layout problem demonstration.
   Th. 15 Jul. — T - Further critique of Institute's engine-plant project; Foundry report; Metal-furniture plant example in display; Slides of handling equipment; Start Systematic Storage Planning (SSP).
   Fri. 16 Jul. — T - SSP continued.
   Sat. 17 Jul. — T - SSP continued; Time to work on enrollee displays
4. Sun. 18 Jul. — Church at U.S. Consulate; Beihai Park.
   Mon. 19 Jul. — T - Integrating SLP & SHA; Extension into Systematic Planning of Industrial Facilities (SPIF).
   Tues. 20 Jul. — T - SPIF continued.
   Wed. 21 Jul. — T - SPIF continued; Outline & session breakdown of new Chinese M.H. training course.
   Th. 22 Jul. — T - SPIF problems application.
   Fri. 23 Jul. — T - SPIF problems application.
   Sat. 24 Jul. — Exhibition of enrollee's projects; Plus interview.
5. Sun. 25 Jul. — Great Wall and Ming Tombs.
   Mon. 26 Jul. — T - Slides of equipment and procedure examples.
   Tues. 27 Jul. — T - Begin Long Range Planning of Industrial Facilities.
   Wed. 28 Jul. — T - Long Range Planning of Industrial Facilities continued.
   Th. 29 Jul. — T - Case problem application.
   Fri. 29 Jul. — T - Second-carry through case problem.
   Sat. 30 Jul. — Final exam, grading, close of formal training sessions.
6. Sun. 1 Aug. — Travel to Shanghai; Visit & discussion at Shanghai Diesel Engine Plant.
   Mon. 2 Aug. — Shanghai Automobile Electrical Machinery Factory—consulting on facilities plans and handling methods.
   Tues. 3 Aug. — Day-long lecture presentation on materials handling, to 100-plus engineers and planners (at International Club, Shanghai).
   Wed. 4 Aug. — River trip to see waterfront handling methods; Yu Yuan Park; Jade buddhas; Travel to Hangzhou.
   Th. 5 Aug. — Visit Hangzhou Gear Box Works (two plants) and preparation of discussion of suggestions for improvements.
   Fri. 6 Aug. — Visit to Hangzhou Steam Turbine Plant and preparation & discussion of suggestions for improvements.
   Sat. 7 Aug. — Presentation to 100-plus engineers and planners from plants and institutes on materials handling importance, fundamentals, not-so-obvious features, and how to approach projects & materials handling analysis (at Hall for Scientific Meetings, Hangzhou).
7. Sun. 8 Aug. — Sightseeing in Hangzhou and return to Beijing.
   Mon. 9 Aug. — Outline report to United Nations (preliminary); Review in detail outline for two-week course on Materials Handling and M.H. Analysis, and discuss with leader.
   Tues. 10 Aug. — Meeting with Ding et al regarding program; Wrap-up, book translations, arrangements, etc.

* "T" indicates training day of 7 classroom hours each.

EXHIBIT 3

Wed. 11 Aug.--	De-briefing at UNIDO with Mr. Sissingh; Visit and General comments to Vice Minister SHENG Lie-Zhu.
Th. 12 Aug. --	Review two outlines and schedules of one-week courses in Chinese on Layout Planning and Systematic Planning of Industrial Facilities; Get-together with officials of the Central Institute, enrollees, and staff for expressions of mutual respect and friendship.
Fri.13 Aug. --	Pack and departure.
Wed.18 Aug. --	Write report to UNIDO
Tues.23 Aug.--	Accounting and expenditure reports

EXHIBIT 4

SPECIFIC PLANTS INVOLVED WITH CONSULTING IN SHANGHAI AND HANGZHOU*

Shanghai Diesel Engine Plant
YUAN Xi-jian, Vice Chief Engineer

Shanghai Automobile Electric Machinery Factory
Mister LE, Director

Hangzhou Gearbox Works
YING Zhi-xian, Factory Director
REN Wenang, Sales Director

Hangzhou Steam Turbine Factory
Mister HUA, Chief Engineer
HUANG Yin-gou, Staff Engineer (interpreter)

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* Arrangements made by:

Shanghai Institute of Plant Design & Research for Electrical & Mechanical Facilities
LU Dao-sheng, Deputy Director
YANG Gen-xiang, Engineer

Second Institute of Plant Design of Machine Building Ministry
PAN De-qing, Engineering Industries Bureau of Zhejiang
JIN Zhao-sheng, Chief of Space Planning Dept.

APPENDIX I

COMMENTS AND SUGGESTIONS FOR UNIDO

from Materials Handling Expert in China--
Richard MUTHER, Feb.-Mar. and July-Aug. 1982

The project was well planned and information sent to the expert/consultant ahead of time was quite specific. However, there were many problems which had to be taken care of by the expert/consultant in order to insure a really good project because so much depends on the expert in this type of training/consulting project. Some of these problems included:

1. Expensive make-ready was involved by the expert/consultant before coming to China:

   . Selecting a program of best content.

   . Organizing eight weeks of full-day training materials--of 40 classroom hours per week.

   . Sending ahead (for translation) books and work-sheets/passouts and lecture notes.

   . Organizing and preparing suitable training aids and manuals.

   . Preparation of two major case problems in the specific industries of the two cooperating plants...

   . Adjusting above to uncertain visual-aid limitations.

   . Projection equipment was brought by the expert himself at the request of the Institute (two projectors and transformer) for which he was reimbursed by the Institute for out-of-pocket equipment cost only.

2. In Beijing, problems occurred:

   . Developing a suitable plan and schedule.

   . Mechanics of the tight schedule of arrangements.

   . Integrating the coordinating plants into the program to be helpful to both the plants and the enrollees.

. Fixing up the training room facilities.

. Working under very limited training-room facilities.

3. During the mission, problems included:

. No real training programs of this kind had been presented before.

. The expert seemed to be expected to take charge, so he did so.

. Problems in getting training materials copied because of limited availability of copying machine.

Recognizing that UNIDO is a big operation, with hundreds of projects, I hesitate to make suggestions. However, for what they may be worth, I submit the following for possible future assignments:

1. If training is involved, try to have the specific content of the course(s) and the limitations of the training room well understood in advance.

2. Consider writing into the agreement time for the expert to organize and select his materials and training aids.

3. If the expert is expected to supply "lecture notes" or "books" to be translated to the client's language, that should be in the agreement at the start. This will help avoid violating copyright agreements by expert and client, or putting the expert in a position of giving away materials normally sold by publishers. Also, some financial reimbursement for mailing, purchase of materials requested, etc. could well be indicated. My letter of inquiry into this was misunderstood.

4. If the project is as full and demanding of the expert's time as this has been, be sure the expert is housed conveniently. (The Institute was exceptionally handy to my hotel and the opportunity to get away from the group and rest for a few minutes each noon was invaluable.)

5. On training/consulting projects of this kind--especially when someone of Mr. Sissingh's background with UNIDO and prior experience with the topic area

is available on location--direct flight, rather than extra time and cost to brief/de-brief in Vienna, would seem realistic--as was done in this case, but only with uncertainties, delays in travel scheduling, written special requests, and extra effort on the part of the expert.

All of this involved more than 12 man-days and a direct cost of some $1200 not reimbursable to the expert.

APPENDIX II

COMMENTS AND SUGGESTIONS FOR

CENTRAL INSTITUTE OF PLANT DESIGN & RESEARCH

AND MINISTRY OF MACHINE BUILDING INDUSTRY

from Materials Handling Expert in China
Richard MUTHER, Feb.-Mar. and July-Aug. 1982

1. First and foremost, the cooperation and assistance given by members of the Central Institute was outstanding. As a first experience in this kind of training/consulting activity, you are certainly to be commended. The interpreter was unusually competent and genuinely helpful in many, many ways.

2. The various activities of the overall project were well balanced and I believe accomplished, both in breadth and depth, probably more than was expected initially.

3. Recognize that seven classroom hours a day is hard on both enrollees and the expert. The rest which you arranged at mid-day turned out to be essential. The convenient office for expert and interpreter was well done. The air-conditioning equipment really helped.

4. The training room should have been better. For the investment of time and money, it is too bad we were so limited. Specifically, I'd suggest you consider, for another such effort, the following:

   a. Less crowding together of enrollees; more room to work.

   b. Large screen or cleaner-and-lighter wall for projecting slides and transparencies.

   c. Avoidance of noise distractions both from the street and corridor, and from construction work on the building.

   d. Fans that don't continually blow away the expert's (lecturer's) notes, instruction materials, visual aids...

   e. Capability to duplicate (copy) worksheets, forms and the like, that is more readily available. (Only by my having extensive well-prepared and sent-in-advance materials were we successful.

5. Balancing the lectures with good problem application and with assigned work at cooperating plants (as we were able to develop), had a very important influence on the success of the overall project. Be aware that other experts who may work with you in the future will probably not have both the practical and teaching experience, and the extensive texts and problem-application material that I was able to bring to you. But in any case, break up the lectures with application work of some kind. Note that problem work for the enrollees gives the lecturer and interpreter a chance to "breathe" as well as providing change of activity for the enrollees.

6. I had the feeling, and it seemed to be verified (at least in part) by the enrollees, that as planners and analysts, they are not involved with capital-investment cost estimates and with cost justification. I did not pursue this area too deeply. Still, I believe there is a very important point here. Planners and analysts must be able to make their recommendations on economic considerations as well as other less tangible factors. They know the equipment they are selecting firsthand and they can visualize or simulate how it is to operate. How can some person removed from the planning engineering properly develop cost information without the direct involvement of the planner/engineer?

7. I'd suggest you encourage, support, and push hard to make an initial success of the proposed new course we have outlined on materials handling and M.H. Analysis. This has some of the latest techniques available; it has material that has proved effective; it has much of its content already available in Chinese language. Good case problem material is available from projects done at the Beijing plants. There can be a major influence on the machine-building industry by such training, both for institutes and the operating plants all over China. The one-week courses outlined for Layout Planning and Systematic Planning of Industrial Facilities should also be developed for presentation, but I'd be inclined to be sure the two-week materials handling course proves itself before moving ahead aggressively with the other two.

8. For another overall project, I'd suggest you lay stress on cost justification techniques; planning, scheduling, and control of projects; and comprehensive planning of industrial facilities that tie-in with the long-range plans for each plant or family of plants. A continuing (on-going) program of coordinated facilities plans can

save significant materials handling costs in the future. Moreover, it can serve as a snowplow to let others in management see a progressive planning program in action at their plant(s).

9. One way to take advantage of No. 8 above is a program of training and guidance in Long Range Planning of Industrial Facilities. For example:

   a. Select four to six participating plants.

   b. Select one institute engineer and one in-company planner for each participating plant, making four to six pairs/teams.

   c. Free these 8 to 12 people from other duties for four months.

   d. Provide them with training and guidance in Long Range Planning of Industrial Facilities (LRPIF) with a competent trainer/consultant who knows the pertinent principles and techniques of LRPIF. This could be done in Beijing--for 2 to 4 weeks--followed by a visit by the trainer/consultant to each of the four to six plants (with the two team members) to plan with that plant's top management a comprehensive facilities planning project and to obtain basic input data, mission statement, alternative situation scenarios...for that plant. I would anticipate two to three days by the trainer/consultant at each plant (or cluster of plant sites).

   e. Each team of two, at each plant, would make its long-range comprehensive facilities plans for that plant, during the next two months.

   f. The trainer/consultant would return for another four-to-six-week period, visiting each plant, reviewing in detail the planning documents, critiquing the alternative plans made, guiding the selection with top management of the best plan, and specifying how the planning work done should be put into form for duplicating the specific case study/example of that plant. All case studies/examples for the four to six plants in question could then be printed together and distributed throughout China, perhaps including an introduction of the principles and techniques to be followed in such planning at other plants.

APPENDIX II

10. Another way of doing No. 9 above, is to send some engineer from the Central Instutute to our firm--Richard Muther & Associates (RMA) in Kansas City. We will put him to work using our methods and include him in our training courses. He could then return to China and lead the same program outlined in No. 9 above.

    Requirements for this latter program would be as follows (as I see it, preliminarily):

    a. Individual selected must have had some training in SHA, SLP, SPIF before coming.

    b. Individual selected must be able to read, write, speak and understand English.

    c. Individual must stay with us for approximately six months, with a very minimum of four months depending on our schedules and his capabilities.

    d. Individual must be supported with funds for adequate living and travel within the USA.

    e. This special training/guidance program must be part of a formalized larger program of guiding Chinese plants to better long-range facilities plans--such as having the individual selected lead a project like No. 9 above upon his return.

    f. The individual would pay no fee to RMA; we would arrange to have him attend training programs presented by us at no charge, and we would supply him with training materials provided in return, he is instructed to work for and with us as we direct and that any materials provided by us carries a courtesy credit line identifying the source on each sheet.

    Still a better plan might be to do both No. 9 and No. 10 above--the visit to RMA first; followed by the training and guidance by one of RMA's qualified training/consultants, with the individual trained by RMA acting as coordinator, interpreter, and on-the-scene counsellor during the period between visits of our trainer/consultant.

Note: For those readers of this report who are not intimately concerned with the authorities in the field of planning industrial facilities, you may wish to know that Richard

Muther & Associates, Inc. (RMA), consultants to industry throughout the world, are internationally recognized as the pioneers of LRPIF. They have developed most of the philosophies and techniques of LRPIF, and have presented--through training and consulting--these techniques in more than ten countries.

AN AMERICAN PLANNER OF INDUSTRIAL FACILITIES LOOKS AT MANUFACTURING PLANTS IN CHINA

by Richard Muther
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of Kansas City, Missouri, USA

During February-March and July-August 1982, Richard MUTHER visited China. He was the guest of the Central Institute of Plant Design & Research of the Ministry of Machine Building Industries. He trained 34 engineers from various provinces in his systematic methods of planning and visited six machine-building plants in Beijing, Shanghai and Hangzhou. Mr. Muther is the author of six books on industrial facilities planning, former faculty member at Massachusetts Institute of Technology and head of his own consulting company with affiliate offices in five countries. He has seen industry in many lands, going back some 50 years.

I have been invited to share my views on Chinese machine-building plants. Hopefully, my comments will be helpful. However, please recognize that they are based on observations and discussions at only six plants, each involved in manufacturing machinery or mechanical components.

Moreover, my comments are addressed to the opportunities for improvement. They are not written to be critical, for I am well aware of the magnificant job done by Chinese industry in the past thirty years.

1. Many Employees

Perhaps the thing that most impresses western eyes is the number of workers in Chinese plants. We know China has an untold supply of people. We understand that labor wages and living costs are much less than ours. We know that often many workers are involved in services to support other workers living at the plant. And we appreciate the fact that the government is doing a fine job in providing employment for everyone. Still, the very numbers of workers--often seeming not to be fully productive--are noticeable.

2. Housekeeping

Managers of most western plants believe there is a correlation between quality of product produced and quality of the environment in which that product is produced. How can a company produce good quality, we ask, when its plant facilities are dark, uncomfortable, dirty and run-down? With all the people available to keep plant facilities clean, it is somewhat surprising more emphasis is not placed on simple housekeeping, both inside and outside plant buildings. In some plants, I've seen, I'd be tempted to hold a Civic Virtue's Day every month.

Orderliness becomes especially important for materials-handling workers. They produce no product, only move, stack, store and deliver materials. So, when they do not do treat materials and tools properly, they not only damage products but they aggravate the production worker. He has done his best to treat the material with respect and put quality into the product, so he becomes demoralized if handlers are not disciplined to lean over backwards to travel with care, pick-up and set-down carefully, avoid spills, stack properly, line-up material neatly, and generally to set an example to others. And because they travel into many departments, the attitudes of material handlers can become contagious.

3. Safety of Workers

Precautions to avoid injury to workers I found to be surprisingly absent. Protective shields or safety glasses for machinists and grinders, protective/re-enforced shoes, guards for moving or rotating pieces of machinery--are to a great extent lacking. And, while I understand the lowly position of the manual worker historically in China, I had hoped that in the Peoples Republic more attention would have been given to protecting the people from industrial accidents.

This is particularly significant when handling materials because about half the industrial accidents occur when materials are being moved. Would it be too radical an idea to train all materials-handling workers in a stiff course in preventative safety and then appoint them as policemen of good safety practices?

4. Maintenance

Along with the above goes maintenance of plant and equipment. I find it to be less effectively organized and generally considered less important than in similar modern western companies. This includes the condition of plant roadways and internal aisles, number of machines or pieces of equipment not operating because of repairs to them, damaged containers still continuing to be in use, casualness about reporting obvious conditions needing repair, fork-lift trucks with a service life of only two or three years...

I can only surmise that there is lack of understanding somewhere in the chain of management, that the absence of proper maintenance can be very costly. These costs include shortened service life of machinery or equipment, more serious breakdowns and therefore more cost to repair, disruption to production schedules, increased accident rate... A good maintenance program aimed at a practical minimum downtime for equipment would seem to be an opportunity for savings--especially when labor costs are relatively low and equipment costs are relatively high.

5. Overhead Traveling Cranes

I observed what seems to me to be overdependence on overhead traveling cranes. This is probably because an overhead traveling crane has range of movement, ample lifting capacity, and the capability to handle many different items. However, cranes designed to pick-up, transport and set-down materials, are costly to use when they only pick-up and set-down material (as compared

to travel with it), when they are used to hold material while an operation is performed on it, when they interfere with travel of other crane bridges on the same set of rails, when they delay production workers by not being available when needed, or when the flow of material requires much shifting from one bay or building to others.

I suggest more use of fork trucks and pallets, (plus local jib cranes (swing cranes) for loading heavy pieces into and out from machines). An inexpensive pallet will keep materials off the floor and save time in pick-up and set-down. Pallets can be readily moved short distances (1 to 50 m.) by hand-operated pallet tansporter (low-lift truck)--either powered or manual. Depending on the condition of the plant floors, loads up to 2000 kilograms can be handled manually this way. Conventional fork-lift trucks (man-riding and counter balanced) can support the pallet transporters for moves of longer distances (10 to 150 m.). Of course, flat-bed trucks or industrial tractor-trailer trains should be used when distances are regularly more than 100 meters, especially if they travel out-of-doors.

Where parts or components are heavy, local jib/swing cranes can be used at each machine (or each pair of them)--with either pallet-and-lift-truck systems, or with overhead traveling cranes. These comments do not mean to exclude the use of conveyors. They are highly practical when the routes are definite and consistently in the same sequence and the quantity of each item is high and/or the item is awkward to handle.

6. Scheduling and Dispatching of Moves

In western plants, we often fail to realize the inevitable interrelationship between, a) planning of handling equipment, b) operating that equipment, and c) the scheduling and dispatching of that equipment. The best engineered handling equipment is no better than poor physical equipment unless it is operated as it was

intended and is scheduled and controlled suitably. The three go together: handling method, physical operation of it, and dispatching and control. I believe you also, in Chinese manufacturing, need to place more emphasis on this.

For example, in several of the plants, I observed dispatching consisted of a general understanding that when a department had completed work on the item, that department should take it to the next-following department. This is a simple system but it does not encourage minimum through-put time. Perhaps more serious, it means that very often a fork-lift truck, which is available for intra-deparment moves is assigned to inter-department moves, to which it often is not suited--wrong economic distances, wrong type of tires, wrong route conditions...

I would suggest investigation of tractor-trailer trains for general inter-department moves, controlled by a central production-control-and-dispatching system, while leaving equipment assigned to moves within each department under the control of that department. I envisage the use of a canal/channel pattern of moves with in-and-out stations at each zone (department, part of a department, or combination of two smaller departments).

7. Participation and Coordination

When one designs a coal-fired electricl generating plant, a blast furnace or oil refinery, the basic process is standardized, it is direct, and the input and output materials are well-established items. In machinery industries, the products are subject to design changes, the materials may be different, operations of the process are adjusted and routings, layouts, machines and tooling all change frequently. In the former case, a power plant can be designed, built and turned over to the operators. In manufacturing, this is seldom the case. Planning a manufacturing plant's layout and handling methods are subject to an understanding of how that

plant will be operated; how layout affects handling, dispatching and storing methods; what changes are likely to occur periodically or permanently; and the idiosyncracies of management policy and supervisory preferences.

As a result, in manufacturing, there is a need for participative planning--engineer and operating manager--and for coordinating--at various phases or levels of each project--and for integrating the plans for layout, handling, communications/controls, utilities and building/structure. This type of planning did not seem to be readily apparent at most of the plants I visited. I'd suggest a more hand-in-hand participative planning.

8. Longer-Term Planning

Studies in other lands indicate that in existing plants, the lack of a comprehensive or master facilities plan is probably the single most-important cause of high materials handling costs. At one plant I visited, the chief engineer readily pointed out that the original planning for the first-constructed buildings was fine for material flow but that they had "spoiled their flow pattern and handling methods when we expanded the plant later". Another plant was planning to add a four-story building to an already over-saturated site without considering other alternatives like site expansion, a new site, or splitting-off some of the operations.

China has a big future in industry; I think its companies should think bigger. In its present state of industrial growth, an effort to instill long-term facilities planning into its industrial plants would bring valuable benefits to China. This applies to both individual plants and planning institutes. I can envisage a long-term master facilities plan being submitted to its ministry by each plant each year. In this way, longer-term plans will indeed be made, facilities planning will become an ongoing activity, and short-term plans can be made faster and better.

9. Costs and Cost Justification

I don't understand what means are followed by companies to justify their investments in plant and equipment. I did not pursue this question too deeply as I sensed I was embarrassing those whom I questioned. But several indications lead me to feel there is significant opportunity for improvement. The calculation of investment costs, fixed-asset depreciation, interest lost when tied-up in materials, return on investment comparisons...all seem not to be clearly understood by planners of plant and equipment.

Western planners and analysts are taught to understand cost analysis in order to make economic recommendations. And, while availability of funds and numerous intangible considerations are important in decision-making, it seems to me that cost justification is a rather cloudy area for Chinese engineers and managers.

10. Responsibility

I don't really know how to title this point. It involves so many different things.

Individuals I met in China are very honest. They are extremely punctual. They do what they say they will. Yet, sometimes, there were too many persons trying to be helpful and it lead to confusion. Sometimes, everyone agreed but none accepted the responsibility to get it done. Occasionally, I requested action be taken, but it couldn't be done because of some other authorities. Engineers I worked with had trouble identifying causes for idle or lost handling time because they couln't or wouldn't try to fix the reason for the cause of that idleness...

We tend to be oriented toward results, at least in the USA. In our style of management, we tend to fix responsibilities in each individual. We tend to delegate decision-making to appropriate lower levels

of management and engineering. I would in no way want to change the graciousness and sensitivity of my Chinese colleagues; I guess I would suggest only that they consider the benefits of being a bit more direct and be held a bit more accountable in their planning work and project management.

Postscript by Author

It is hard to make suggestions for improvement to those whose experience and culture go back for centuries--far beyond those of my own country. However, in industrial operations, we do have more experience and perhaps more success than most. So, it is only with a sincere interest in trying to help others modernize their industry that with this article I take the risk of being considered too critical.

Richard Muther
23 August 1982