

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte  
**Band:** 53 (1986)

**Artikel:** Small contractors in developing countries during the economic depression  
**Autor:** Jiang, Daniel Du Hsin  
**DOI:** <https://doi.org/10.5169/seals-41114>

#### **Nutzungsbedingungen**

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

#### **Conditions d'utilisation**

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

#### **Terms of use**

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

**Download PDF:** 20.02.2026

**ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>**

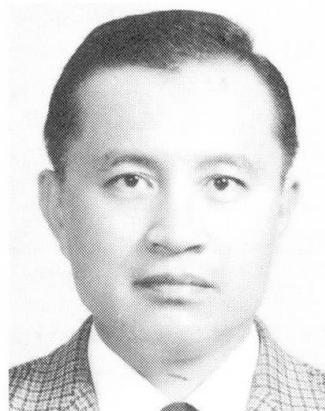
## **Small Contractors in Developing Countries during the Economic Depression**

**Petits entrepreneurs dans les pays en voie de développement  
en période de dépression économique**

**Strategie für kleine Bauunternehmungen in Entwicklungsländern  
während der wirtschaftlichen Depression**

**Daniel Du Hsin JIANG**

Professor  
Feng Chia University  
Taichung, Taiwan



Daniel Jiang born in 1983. Received his B.E. diploma from Chung Yuan University Dip. H.E. from IHE Delft and Doctor of Applied Science from K.U. Leuven Belgium. He is dean of the Graduate Institute of Civil Hydraulic Eng. FCU and consultant for several firms in Taiwan.

### **SUMMARY**

This paper takes a review on the development of the construction industry in developing countries and tries to find out a way for those small contractors to adjust themselves during the economic depression and facing the high technological world.

### **RÉSUMÉ**

La contribution traite du développement de l'industrie de la construction dans les pays en voie de développement et essaie de trouver un moyen pour les petits entrepreneurs de s'adapter en période de dépression économique et d'être capables de progresser dans le monde nouveau de la technologie avancée.

### **ZUSAMMENFASSUNG**

Dieser Beitrag gibt eine Übersicht über die Entwicklung der Bauindustrie in den Entwicklungsländern und versucht, für kleinere Unternehmungen einen Ausweg aus der heutigen, wirtschaftlichen Depression aufzuzeigen. Gleichzeitig soll damit auch der Anschluss an die rasche, technologische Entwicklung im Bauwesen sichergestellt werden.



## 1. INTRODUCTION

Economic development is a goal not only for a nation but also for the whole human beings. It goes onward but has fluctuations. Construction industry usually takes as a leading role like a locomotive to pull the economic development onward. Because construction project is complex in materials and manpower. It is also largely influence on the market and banking activity. The production stand there has shown the practical results of the economic growth both in quantitative materials and in quality of human life. This is specially true for those well developed tiny Asia economic giants.

Construction industry builds up real estates and joints the public works which keep the idle money as a revolving fund for the investor. Thus during the economic take off the easiest and fast developed industry is the construction industry. But when the economic recession comes, just like now, the over expanded construction industry are no longer in order and turn into catastrophe.

Take a view from the technology: in the beginning they import construction method, materials and machines from the foreign country. Only the assembly works were done locally. In order to earn the know how to transfer the design process, the local partners have divided into consultants and contractors. They gain the experiences and gradually work independently and even turned into an opposition party in job hunting and construction supervision. Now a day most of the construction works are high-tech and the rest remain very hard competition. The educational background of those small contractor are very limited. The old generation although they won the business but is getting old to adapt to the modern technology and management. Thus very few of them are able to stay alive. Those over expanded contractor has turn into trouble because of recent economic recession.

Main problems for those small contractors are the ill organization, poor management, lack of high construction technology, ignore in financial operation and over establishment of contractor firms.

Now, a new philosophy to handle the business is necessary. The purpose of this paper is try to find out a way for the small contractors to adjust themself during the economic transfer period and to grow up again.

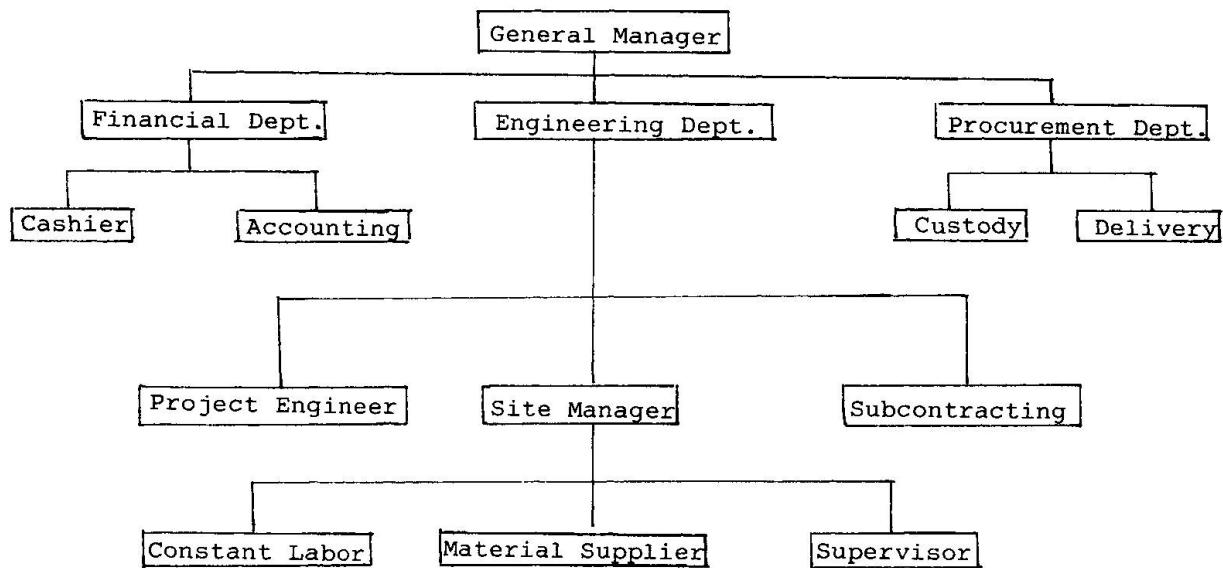


Table 1. General organization of small contractor

## 2. PRESENT SITUATION OF THE SMALL CONTRACTOR

The so-called small contractor is limited by their registered capital up to us \$600,000.- only. The organization of this kind of contractor are shown in Table 1.

Usually they divide in 3 grades depending on the capital. It is necessary to know which department are taken charge of the cost flow. Table 2 shows this purpose:

| Organization               | Financial Dept. | Engineering Dept. |                |          | Procurement Dept. | General Manager |     |  |
|----------------------------|-----------------|-------------------|----------------|----------|-------------------|-----------------|-----|--|
|                            |                 | Site Manager      |                | Delivery |                   |                 |     |  |
|                            |                 | Project Engineer  | Constant Labor |          |                   |                 |     |  |
| Cost Data                  | Accounting      | Cashier           | Subcontracting |          | Material Supplier |                 |     |  |
| Procurement                | D               | D                 |                |          | D                 | D               | S D |  |
| Material Receipt           | D               | D                 |                |          | S                 | D               | D   |  |
| Material Requisite         | D               |                   |                | D        | D                 | S               |     |  |
| Material Inventory         |                 |                   |                |          | S                 |                 | D   |  |
| Equipment Time Chart       | D               | D                 |                | D        | S                 |                 |     |  |
| Constant Labor Payroll     | D               | D                 |                |          | S                 |                 |     |  |
| Piece Works Contracting    | D               | D                 | S              |          | D                 |                 |     |  |
| Piece Work Progress        | D               | D                 | D              | D        | S                 |                 |     |  |
| Site Miscellaneous Payment | D               | D                 |                |          | S                 | S               | S   |  |
| Progress Control           |                 |                   |                | S        | D                 |                 | D   |  |
| Cost Control               | S               |                   |                | D        | D                 |                 | D   |  |
| Quality Control            |                 |                   |                | D        | S                 | D               | S D |  |

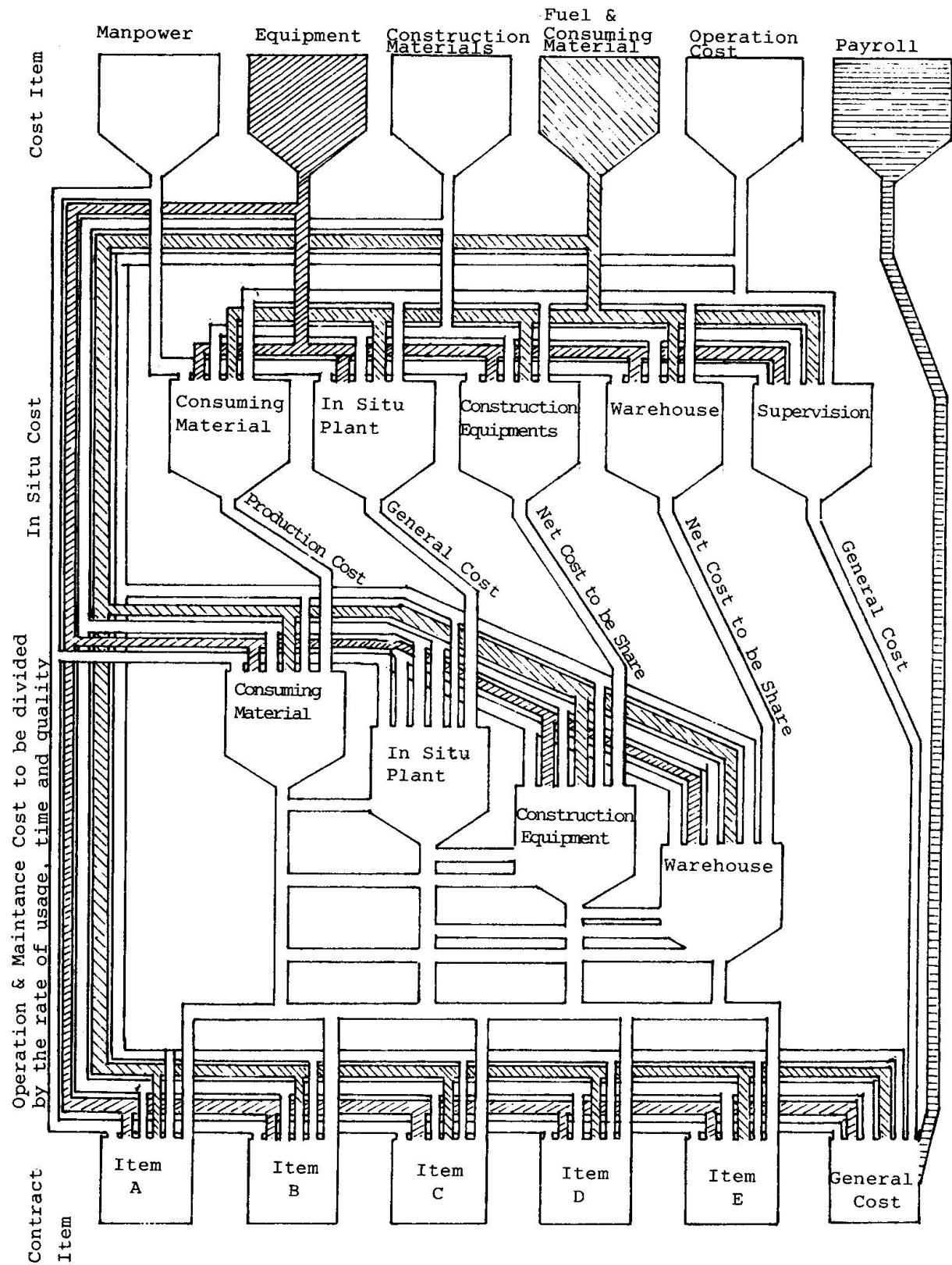
Source of data: S

Delivery of data: D

Table 2. Cost flow in a contractor organization



Table 3 Cost flow chart



### 3. DIFFICULTY AT THE PRESENT SITUATION

Most of the small contractor are serving only on labor consuming works and facing the ill management of own company. The heavy competition on job hunting due to the over expanded in quantity of contractor firms and lack of advanced technology lead to the small contractor very hard to survive.

But the advantage of the small contractor must not be ignored. They join small project, offer labor and share the minor part to the large construction, doing subcontracting works and provide special equipments. These work have link as a part of the social economic activity which is not able to be neglected.

### 4. PROBLEM SHOOTING FOR THE SMALL CONTRACTOR

#### 4.1 Complete information and project control

To win a project usually has the following step: marketing, planning to join the bidding, cost estimate and time schedule, open tender, sign contract, financial arrangement, changing design, appraisement, cost control, final account and approval. Table 3 shows how to divide the cost into different item in the contract.

After we know the division of the cost to the items project control are thus mainly doing the control of cost and the degree of the progress. Project control includes motivation and coordination of the whole project. It has to do the collection, verification and distribution of the cost. It has to analysis the budget and predict the profits and losses. A project control schedule for the small construction are shown in Table 4. An important matter has to point out here that the job number are the itemized construction job. It must be clearly leveling and label.

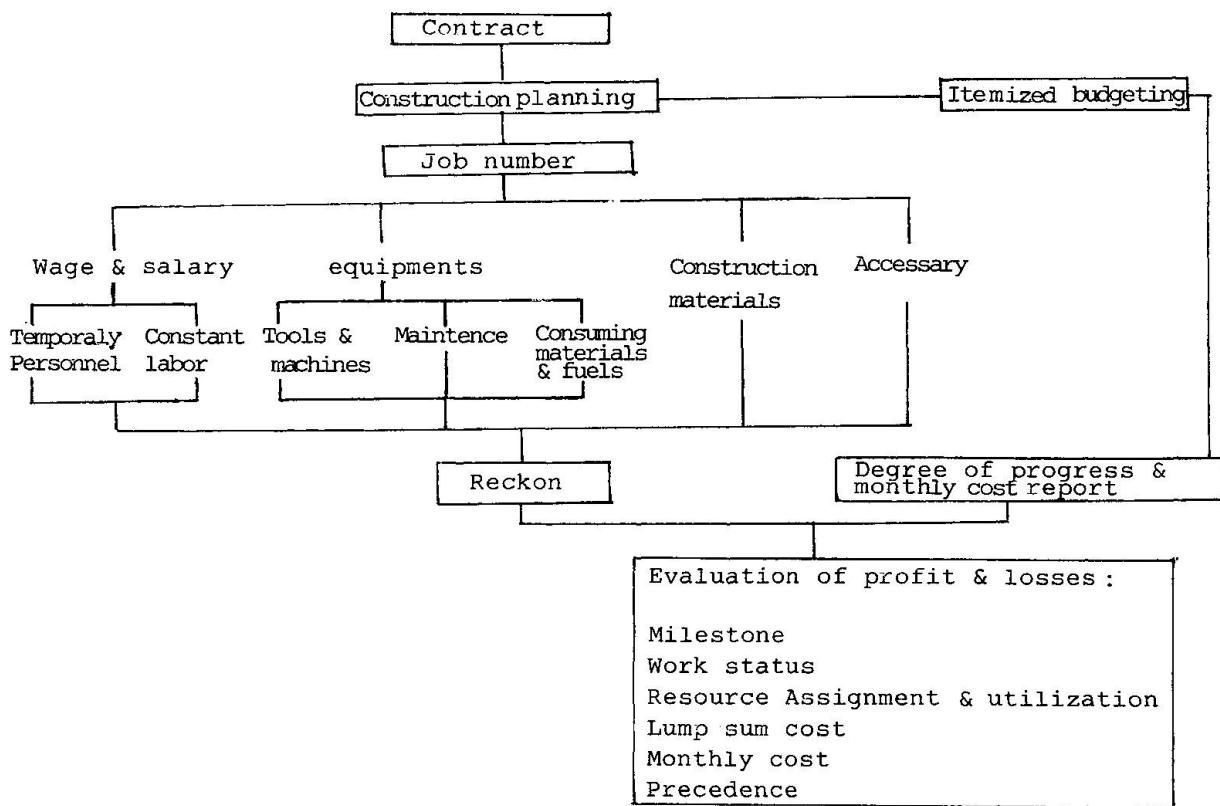


Table 4. Project control schedule



| Item<br>Type of<br>Data |             | Personnel                                       | Construction<br>Material                                    | Equipment   | Progress<br>Control  | Financial &<br>Accounting   |
|-------------------------|-------------|---|---|---|--|---|
| Date Bank               | Main        | Personnel,<br>Payroll,<br>Specialty             | Classification,<br>Specification,<br>Unit cost              | Date of procurement,<br>Expected life,<br>Depreciation,<br>Operation cost | Project validity<br>Work details,<br>Job numbering,<br>possible time<br>for completion | Contracting cost<br>Construction<br>budget,<br>Contracting<br>prices for<br>subcontractor<br>Account number |
| Input Data              | Transaction | Transaction                                     | Quantity of<br>order  | Operation<br>period   | Job completion<br>Completion time<br>Changing of<br>operation time,                    | Receiving,<br>Payment,  |
| Output Data             | Planning    | Manpower  | Material<br>Consumption                                     | Machines<br>Installations   | Critical path<br>of operation,<br>Float time of<br>operation,<br>Surplus of time       | Schedule of<br>working ,<br>capital   |
|                         | Statistics  | Accumulated<br>cost ,<br>Accumulated<br>Man day | Accumulated<br>quantity of<br>order,<br>Accumulated<br>cost | Accumulated<br>time of<br>operation,<br>Accumulated<br>progress           | Predict Progress<br>Accumulated<br>progress  | Accumulated<br>costs ,<br>Analysis of<br>profits and<br>losses  |

Table 5. Data storage for computer

The indirect cost is usually difficult to categorize. But if we know the cost structure and its cost flow entirely and treat it as a whole we can perfectly do the project control. Anyhow small contractor are not dealing with large and complicated project it is no problem to handle it.

#### 4.2 Modernized construction planning and management

During the construction these are mainly the cost, degree of progress and quality of work to be cared. But the fluctuation of market price, changing in weather and design as well as the geological exploration etc. will change the above mentioned figures quickly and seriously. We can provide modern construction management techniques such as piece-wise linearized linear programming, multiobjective decision analysis etc. to have better adaptive and reducing the influences. For instance, during the construction, when we look for the least operation cost we can form a set of non-negative constraint equations; such as design specification, energy efficiency, environmental condition, operation conditions and efficiencies etc, to solve for the objective function with economic operation costs. These costs are the "design parameter" for operating the specific construction.

Another example to deal with the design process in construction is the Mixed Integer Program. This MIP method can be used to solve both the construction cost and the maintenance costs simultaneously to minimize the objective function.

The above mentioned modern techniques for planning & design process for construction management can be done by the micro computer. Problem will be the software designer for those small contractors. With a minor change on the existed software from the market can be useful for the management purposes.

Normally the data for computer processing can be list in Table 5. With all these input data and the existed computer program we can predict and optimalize the construction work.

#### 4.3 Emphasis risk analysis

Construction risk are mainly divided in three parts:

- a. Predictable risk: high possibility to happen but predictable by experiences and statistics of the probability. It can be covered by contractor all risk insurance (CAR).
- b. Speculated risk: Difficult to predict but known by the professional. Beside the CAR insurance it can be covered by reinsurance.
- c. Risk by the act of Gods or war etc., which is not covered by the insurance.

The main reason to have risk are miss cost estimate, uncomplete geological data, using new method of construction and equipments, fluctuation of price and weather, extension of time limit, the efficiency of labor and the execution of supervision. We must understand insurance is not the meaning to share the responsibility. A total prevention has a better efficiency than to make up fault. Thus we must clearly study the contract and the related legal aspects to spread fairly the risk liability on all parties; i.e.: the owner, insurance company, designer, consultants and the contractor.

Using chance-constrained linear programming model is able to control the risk too. The model will put the probability of the said risk on the constraint equations to let those condition under the risk then solving the objective function. The chance constraints must transfer to the deterministic equivalence otherwise it can not fulfill the requirement of the deterministic property of the L.P. model.



#### 4.4 Rationalization of construction management

As a small contractor, first of all, we must choose the goal to joint the competition of bidding. If it is impossible or unqualified then perhaps try to organize a joint-venture which is now a day quite a lot of appealing but very few to call back. Small contractor are usually family business. They can be a sub-contractor but difficult to share the risk of the whole. The organization of the small contractor are not systemized. They have learned the technique from their experiences but the owner or the big boss are getting old. Most of them can not keep up to date and unfortunately they do not trust the licenced engineer or technician. The financial structure is also not in order thus the bank is unable to supply necessary fund.

Joint venture or even doing turn-key process are the meaning to modernize their thinking and management. It open wider possibility for the small contractor to work for. But we need the governmental authority to renew the regulaiton in order to have suitable documents to organize joint venture.

The rationalization of the construciton management we must do as follow:

- a. From the contractor side: Establish sub-contractor system to form group of contractors then encourage the joint venture work and further study to be able to do turn-key job. But all of this must based on a fair evaluation of the administration of the construction industry to classify the rank of the contractor. So they do only what they can do well and then doing up-grade as a incentive to the contractor. Inviting the foreign contractor to cooperate with local firm can import new method and equipment too. Recently this is already opened and shown the efficiency.
- b. From the governmental authority: Review all regulations on the construction industry, intensify the administrative function of the contractor's association, standardized construction materials both on quality and dimension and quality control by inspection. An independant arbitration system and the evaluation of the contractor has to build up too. So the social and economic organization can easily follow up and give right support to the contractor. Those unqualified contractor will be diminished and thus reducing the unnecessary competition during the bidding.

#### 4.5 Improving productivity

Productivity is a ratio of output volume and construction costs or utilitized resources. One of the main problem is the correct coincidence of costs and units of volume. Construction industry consists of many part-productions and supply services. So the productivity figures will have chain influence of the different parts. On the other hand, efficiency and effectivity are also a contributing factor for the productivity. Thus high skill labors with interesting warfare, modern equipments choosed by the experienced foreman, increasing the degree of prefabrication and factory product are well improving the productivity. Now a day the most difficult factor influence on the productivity is the skill labor. Construction labor mostly work in all kind of weather and climate. They must be healthy and strong to carry out heavy and dirty works thus work with high accident rate. They work all round the clock to race with time for the emergency rescue. Although the advantage of the low cost labor are no longer existed in this area but their payment are still more or less the same as the factory worker. So very few worker are willing to join the construction industry. Beside the above mented problems, the local Mafia has not only threatening the public open tender but also control the labor sources thus influence on the productivity of manpower. Small contractors are surely the major victims.

A well organized personnel policy with incentive conditions must be treated on the subcontractor or jobber. Besides, it is necessary to organize on the job

training and safety instruciton for teh constant labor. Small contractor can be specialized in construction technique or doing specified work to skill up themself and increasing the productivity. But don't just specialized because it will cause to narrow the field of job hunting. Application to the construction equipments is another possibility to improve productivity too. But the investment on the equipment should be careful otherwise it cause financial problem of the whole firm.

## 5. CONCLUSION

Industriziation of construction industry is a goal for teh developing countries. Because it will lead other industries forward. Thus modernized the organization of the contractor by computerized administrative work and training the personnel are the most improtant work. Computer application by modern mathe- matic technics for management such as operation research can be found from the existed software, i.e. Quick-Plan, Primavera, Tim-Plan etc. all applicable to the personal computer. Introducing foreign techniques and management process will fast up to upgrade the construction industry. At last but not the least, as we know construction is related to the social economic activity, when we improve productivity incentive policy should be offered not only be the con- tractor but also from public authority.

## REFERENCES

- [1] L.P. Sikkel, P.A. Erkelens, Productivity and Productivity Factors in the Building Industry. IABSE Journal J-25/84.
- [2] K.C. Lee, M.Y. Wu, Applicaitonof Mixed Integer Programming on the Optimal Design of the Water Treatment Facilities (in Chinese), 2nd Water Technology Conference, Taipei, Taiwan R.O.C. Dec. 1985
- [3] C.F. Sheen, Investigation on the Usage of Mini & Micro Computer for the Construction and Suggestion of Development (in Chinese), Taiwan Construction Technology Research Center, Taipei, Taiwan R.O.C. 1984
- [4] C.Hwang, Construciton Management on Slope Land, Taiwan Construction Tech- nology Research Center, Taipei, Taiwan R.O.C. 1983
- [5] R.M. Stark R.H. Mayer, Jr. Quantitative Construction Management, John Wiley & Sons, 1980
- [6] D.W. Halpin, R.W. Woodhead, Construction Management, John wiley & Sons, 1980
- [7] D.I. Cleland, W.R. King, Systems Analysis & Project Management McGraw-Hill Book Co., 1983
- [8] C.H. Chen Enterprise Cost Management (in Chinese), The United Book Co., Taichung, Taiwan R.O.C. 1984
- [9] RSEA Manual, Operation Process of Engineering Control Sub-system, RSEA, Taiwan 1982

Leere Seite  
Blank page  
Page vide