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ESTABLISHMENT OF CONSTRUCTION INDUSTRY CREDIT GUARANTEE SYSTEM—BASED ON TAIWAN'S CONSTRUCTION INDUSTRY

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ABSTRACT: Various construction bonds and warranties critically burden the general contractor. Also, sporadic or cumulative delays of progress payment by the owner can further trap the contractor in a financial quagmire. Facing the possibility of cash flow deficiency and callous response from the banks, most construction firms may become financially incapable of market competition, and attractive project tenders become a bidding game among few deep-pocket players. The downside of such market environment is that the depth of pocket, rather than that of professional competency dictates the choice of market winners. In Taiwan, this has been a potential crisis to the construction industry after the financial crisis which started out since 2008. To encounter this problem, this research will examine the means to better manage the construction industry. Essentially, a credit guarantee system (CGS) is the prime solution to strengthen a bank's confidence in any particular construction firm. Thus establishing a national platform which evaluates and rewards a construction firm's overall credibility is pivotal, and this third-party rated credit can help a bank to render a loan more wisely. Finally, this paper will propose the ideal operating schemes of construction-specific CGS in Taiwan and a credit scoring prototype model for construction industry, as reference for the government and banks, respectively.

Keywords: Credit Guarantee System (CGS); Construction Industry; Construction Bonds; Progress Payments; Cash Flow Management; Financing.

1. INTRODUCTION

In a volatile construction market, construction bonds, such as bid bond, performance bond, payment bond, and various warranties critically burden the general contractor. Also, after the construction work takes place, sporadic or cumulative delays of progress payment by the owner can further trap the general contractor in a financial quagmire. Facing the possibility of cash flow deficiency and callous response from the banks, most construction firms may become financially incapable of market competition, and attractive project tenders become a bidding game among few deep-pocket players. The downside of such market environment is that the depth of pocket, rather than that of professional competency dictates the choice of market winners. And the tendency of bid rigging and similar acts would be imminent. In Taiwan, this has been a potential crisis to the construction industry after the financial crisis which started out since 2008. During that period, a great number of banks quickly withdrew from construction loans, and a greater number of construction firms were either forced to take exit out of the market or to struggle their very survival with the "help" from loan sharks. The unfortunate development within the market is that the industry as a whole is continuously losing its knowledge, experience and skills; and the dysfunctional market competition also causes the owners to worry about the balance between price and value.

To encounter this problem, this research will examine the means to better manage the construction industry. Essentially, a credit guarantee system (CGS) is the prime solution to strengthen a bank's confidence in any particular construction firm. Thus establishing a national platform which evaluates and rewards a construction firm's overall credibility is pivotal, and this third-party rated credit can help a bank to render a loan more wisely. This paper will present the influence of government procurement system on a construction firm's cash flow, financing problems of Taiwan's construction industry, the status quo of credit guarantee for construction firms by SMEG, and key factors in financing between construction firms and banks. It will offer a recommendation regarding the ideal schemes of construction-specific CGS operating models in Taiwan, as reference for the government to form its policy. This paper will also propose a credit scoring prototype model for construction industry, as reference for banks.

The methodologies adopted in this research include paper review on CGS; interviews with officials, managers of construction and banking industry, and scholars; questionnaire survey; and specialist forums on scheme designs.

The contributions of this research are to let construction firms know how to promote their operating and financial management in accordance

with the key loaning factors presented in this paper; to make banks adjust their recognition toward construction industry and to improve the asymmetric information situation; and, by establishing a national construction-specific CGS, to strengthen a bank's confidence in a construction firm and to assist the firm with better rated credit to get a loan smoothly.

2. WHAT IS "CREIT GUARANTEE"?

A "credit guarantee" is usually a key for a small-medium sized enterprise to getting a loan from a bank. While such an enterprise has financing demand, it may directly find a bank to ask for rendering a loan. Except few enterprises who can offer enough securities or have a sound financial and accounting system, most cannot get their desirable results. Meanwhile, a credit guarantee is just the role that can assist to make it. If a bank does not have confidence in such an enterprise, for the security it would consider transferring the enterprise's loan application to a credit guarantee institution for a guarantee. The enterprise may be able to directly apply for a credit guarantee, and then go find a bank for a loan. Hence, essentially "credit guarantee" is designed for financial assistance for small-medium sized enterprises and help enterprises that are potential but lack of securities to obtain required money or credit. Furthermore, it is an effective way to solve the problem of "asymmetric information" between an enterprise and a bank, and may conquer the difficulty in pricing the risk when an enterprise applies for a loan. Giving a credit guarantee is often regarded by scholars as a "subsidy" measure, and is therefore implemented by a professional institution funded by the government in most countries. [1]

3. INFLUENCE OF GOVERNMENT PROCUREMENT SYSTEM ON A CONSTRUCTON FIRM'S CASH FLOW

The tendency of cash flow in a construction project is illustrated in Fig. 1. At the start the cash flow is zero. With the processing of the project, a general contractor has to pay direct costs (personnel, materials, equipments) and indirect costs (bonds, insurances, taxes, etc.) so the cash flow becomes negative, which means the contractor needs to raise money. After the progress payments (except for retainage) are paid by the owner periodically, the cash flow has phased changes but it is still negative. Until the final progress payment has been paid, the cash flow could become positive (means profit) only if the project is finished smoothly. The analysis and management of cash flow is so important that can directly affect the contractor on its survival and competitiveness. Besides, a contractor may execute several projects simultaneously and has to transfer the assignable cash from one project to another. When the required cash is over the usual current cash, it is necessary for the contractor to get short-term loan from a bank, for example.

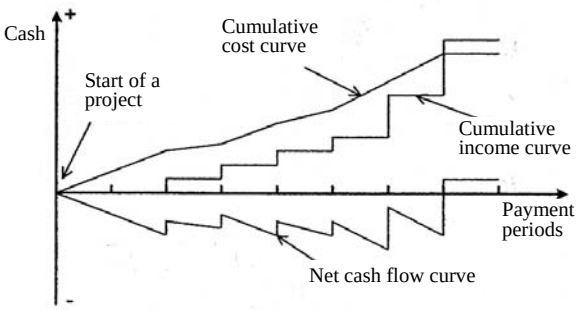

Fig. 1. The general tendency of cash flow in a construction project [2]

In public construction projects, according to the Government Procurement Law, all except those with specific conditions (such as below a certain amount) should ask the bidders to provide bid bonds and the winners should pay various construction bonds (such as performance bond, payment bond, etc.) and warranties. The bid bond is 5 percent of the bidder's bidding price or not over 50 million NT dollars (about 1.7 millions USD). The performance bond is 10 percent of the contract amount and the construction warranties are below 5 percent of the contract amount in principle. Except for cash, now the Law has allowed a contractor to submit guarantee agreements conferred by a third party (usually banks) or other securities to the owner.

As previously described, the cash flow of a project is always negative, not to mention the public construction projects. There are bid bond, performance bond and retainage, etc. during construction. In addition, there are construction warranties which almost equal the contractor's deserved profit (generally, 3~5% of the contract amount). The warranties will be retained by the owner for several years and cannot be utilized by the contractor within that period. To be worse, the owner could sometimes delay progress payments so the contractor has to raise money with extra cost of interests. These factors make contractors heavy burden in their cash flow and financial assignment, especially for the small-medium sized firms. Some agencies of local government may have annual budget problems or disputes with contractors more likely so the contractor cannot get the payment in a short time and could result in financial crisis. Based on this, the lending bank would withdraw money right away. To add fuel into fire, the contractor would be out of operation at last.

4. FINANCING PROBLEMS OF TAIWAN'S CONSTRUCTION INDUSTRY

According to the definition of small-medium sized enterprises in Taiwan, the capital of an enterprise is below 80 million NT dollars (about 2.7 millions USD) or its number of employees is below 250 persons. Nearly 90 percent of construction firms fit in the definition. Besides, according to the statistics, these firms raise money by the ways as following in sequence: Loaning from banks; Increasing capital by cash; Using retained earnings or reserves of the firm; Borrowing money from relatives or

friends; and Bidding in loan clubs, etc. Recently the financial and capital market in Taiwan has been well developed so medium enterprises can enter into the capital market to raise fund as well. However, financing through the banks is still a mainstream.

Due to the following reasons, construction firms have difficulty in getting loans from banks: rigorous review by banks, inadequate securities provided by borrowers, stagnant development of the industry, and high lending rate of interests. The first reason can be further observed from the 5P principles adopted by most banks before rendering a loan or conferring a guarantee. These principles are:

- People: To investigate the history, capabilities, and credit record of a borrower, and its relational enterprises, etc.
- Purpose: To evaluate if the usage of a loan by a borrower is appropriate and legal in advance, and to track if the loan is used according to the plan afterwards.
- Payment: The source of debt-paying is the first priority that ensures the creditor's right. To analyze the source is the core of the 5P principles.
- Protection: To protect the creditor's right is second in priorities. For preventing incapability of the payment source, there are two protection measures:
  - Internal Protection: including (i) good financial structure of a borrower; (ii) sound loaning contract conditions; and (iii) a borrower's asset as surety.
  - External Protection: including (i) guarantors (credit guarantee institution included); (ii) endorsement guarantee; and (iii) the asset of a third party provided as surety.
- Perspective: To make profits (such as interests and fees) from credit applications, a bank itself has to undertake the risk of losing the creditor's right as well. Hence, the bank needs notice the perspective of a borrower and its future development. Under sound consideration between profits and risk, a decision will be made.

Generally speaking, compared with large sized enterprises, small-medium firms are more difficult to achieve the 5P principles. In other words, the latter has some common internal problems or bad conditions and then reduces the bank's confidence toward rendering a loan. These internal factors are:

- Unsound accounting system and/or unreal financial report;
- Low equity and weak financial structure;
- Lack of sureties or appropriate guarantors;
- Incapability of financial planning;
- Low information transparency of the firm's operation;
- Credit flaws of the firm's proprietor.

According to related papers and interviews with several Banking managers, the external factors that may affect construction firms on loaning are:

- The Enterprise Credit Rating Indexes: the Indexes adopted by banks to rate a borrower are all the same, which is unfair to the risky construction industry;
- The ability of a bank to manage risks: some banks do not have an appropriate risk management mechanism so they prevent from loaning to construction industry or will give different lending conditions;
- The financial situation of the owner of a project: most central government agencies pay the progress payments regularly but some local government ones do not due to their annual budget deficiency;
- The governmental policy of assisting the industrial development: the perspective of the industry in Taiwan is unclear and the government does not have concrete assistance measures.

5. STATUS QUO OF CREDIT GUARANTEE FOR CONSTRUCTION FIRMS BY SMEG

As described above, few small-medium sized construction firms will get required loans successfully. Lending applications from most firms will be directly transferred to the Small and Medium Enterprise Credit Guarantee Fund of Taiwan (SMEG), a professional institution, and asked for a guarantee. If SMEG reviews and promises to take partial risk, the bank will render a loan or will reject the application. According to the borrower's credit conditions, SMEG decides the guarantee amount or percentage of a loan. The credit conditions can be divided into two aspects as following:

- Financial aspect: short-term liquidity, profitability, financial structure, operation performance, and ratio of loans/incomes ;
- Non-financial aspect: clearing credit, debt-paying record, relational enterprises, operating team, industrial perspective, R&D situations, intangible assets, and other credit related factors.

As to the SMEG's guarantee services, there are several items related to or provided for construction industry. For example, Working Capital Loaning for Procurement and Performance Bonds are general guarantee items, and SME Participating Public Works Loaning is a policy-based guarantee item. The guarantee amount of loans for construction industry is around 60 billion NT dollars (about 2 billion USD) per year, which is 13 percent of the total guarantee amount of SMEG. This percentage is the third high in all industries of Taiwan. However, the number of construction firms is only one percent of 1.3 million small-medium sized enterprises. It seems that the construction industry has already occupied much governmental financing resource. This is a skewed viewpoint because large guarantee amount for performance bonds is retained by the owners of construction projects (some of them are governmental agencies), not utilized by contractors.

Not every guarantee application is approved by SMEG. According to the institution's analysis, the rejected reasons are (including three internal factors of item 1, 2 & 6 in Section 4):

- Inconsistency of the loaning purpose with its usage, and unclear source of debt-paying;
- High ratio of loans/incomes in working capital, or

over the limit of total guarantee amount set for a firm;
- Short operation history and unstable business;
- Huge reduction of incomes or earnings;
- Much stock or high accounts receivable ;
- Other reasons (e.g., the applicant's unwillingness to provide information).

These reasons listed above are not rare to construction industry, especially to small-medium firms. Besides, SMEG has taken more measures of risk control since 2005. One of the measures was implementing three rates of charge (0.75%, 1.0% and 1.5%). To decide the rate of an application depends on its risk. Next, SMEG generally guarantees 50~70 percent of a loan. If a bank asks SMEG to guarantee 80~90 percent, it means this application is highly risky and SMEG may reject the application or impose a higher rate of charge though approved. In other words, a firm may have to pay more charge fee. Plus, the firm needs to pay the lending interest to the bank. To a risky industry such as construction industry, credit guarantee in fact does not help the firm out of a financial quagmire. Furthermore, SMEG asks the construction firm to provide a letter of promise issued by the owner of a project so the progress payments will be saved in a specific bank account. This measure can control the usage of the firm's loan, but limit the flexibility of cash flow if the firm executes several projects simultaneously.

In summary, SMEG does assist some small-medium enterprises to get a loan but has imposed unbeneficial conditions on construction industry as well. To solve financing problems of the industry and improve the industrial development and management, it is necessary for the government to establish a construction-specific CGS and to develop an appropriate credit scoring model for this industry only.

6. IDEAL OPERATING SCHEMES OF CONSTRUCTION-SPECIFIC CGS IN TAIWAN

Through paper review on native and foreign CGSs, five ideal operating schemes of the construction-specific CGS are induced and described respectively as follows. Comparing the five schemes from the aspects of their required capital, operating cost, professional personnel, cooperative banks, operation efficiency, and guarantee services can conclude that Scheme 4 is the best scheme. The comparison results of the five schemes are listed in Table 1.

Scheme 1: CGS Operated by the Government Itself

The scheme is that the government funds and operates the CGS itself. The government should set up or designate a responsible agency and mandate the personnel of the agency to execute reviewing jobs. The organization of the agency can reference that of the U.S. Small Business Administration (SBA). SBA has an Office of Capital Access and under the Office are Office of Financial Assistance and Office of Surety Guarantees, etc.

The scheme needs much capital for all construction firms. Besides, there is no CGS operated by the government in Taiwan and the governmental organization is being planned to shrink. The possibility of adopting it is low.

Scheme 2: CGS Operated by an Institution Setup by the Government

The scheme is that the government sets up a non-profitable independent institution and funds it to operate the CGS. The institution has to organize its units and recruits the personnel necessary for the operation. Its organization can reference that of SMEG or ACGF, which includes four major units of reviewing, compensation, administration, and strategic development. ACGF, abbreviated by Agricultural Credit Guarantee Fund, is the only institution set up for a specific industry in Taiwan. The construction-specific CGS should study the ACGF's establishment history and reference its operation.

The scheme needs the same capital as Scheme 1. Besides, to start up a new institution is uneconomical and grueling. The possibility of adopting it is low as well.

Scheme 3: CGS Operated by SMEG under the Government's Commission

The scheme is that the government funds SMEG and the CGS is committed to it to operate. Because SMEG has provided many services and resources for small-medium construction firms, what the government has to do is to supplement its deficiency by policies. Hence, the scheme needs less capital than the above two schemes. Besides, SMEG has sufficient personnel and expertise so committing it to operate the construction-specific CGS is more economical. The only question is that the commission project is independent in accounting and SMEG will not be responsible for the loss of capital in a normal condition.

Scheme 4: CGS Operated by SMEG with funds from both the Government and SMEG

The scheme is that the government and SMEG co-fund a relative guarantee CGS with equal capital, and the CGS is committed to SMEG to operate. The relative guarantee service was initiated by SMEG in 2006. Not only does the scheme have all advantages of Scheme 3 and have no its disadvantage, but it just needs half the required capital of that Scheme. Hence, the scheme is the best among five schemes.

Scheme 5: CGS Operated by SMEG with funds from both the Industry and SMEG

The scheme is all the same as Scheme 4 but with a different funder. The other funder may be the association of construction firms who collects the required capital. However, to ask the construction industry that currently has no sufficient cash to collect the required capital is not possible. Hence, the possibility of adopting it now is low.

Table 1. Comparison of five operating schemes of the construction-specific credit guarantee system (CGS)

Comparison Items / Schemes	Required Capital	Operating Cost	Professional Personnel	Cooperative Banks	Operating Efficiency	Guarantee Services	Rankings
1. CGS Operated by the Government Itself	5	5	5	4	5	5	5
2. CGS Operated by an Institution Setup by the Government	4	4	4	5	4	4	4
3. CGS Operated by SMEG under the Government's Commission	2	1	1	1	2	2	2
4. CGS Operated by SMEG with funds from both the Government and SMEG	1	1	1	1	1	1	1
5. CGS Operated by SMEG with funds from both the Industry and SMEG	3*	1	1	1	1	1	3

7. CREDIT RATING METHOD FOR CONSTRUCTION-SPECIFIC CGS IN TAIWAN

Whichever scheme is adopted, the construction-specific CGS needs an applicable credit rating method. By this method, the CGS can evaluate and control potential risk of guarantee applications. Nowadays in Taiwan, there are four credit rating or scoring methods with different purposes: the Construction Firm Grading by the Construction Law; the Enterprise Credit Ratings of the Banking Association; the Credit Condition Evaluation of SMEG; and the Construction Industry Model of JCIC. The proposed credit rating method for the CGS is a "composite" method which includes the above four methods and a "new" Project Credit Scoring Model. (A prototype of the Model will be presented in Section 8 of this paper.)

According to the composite credit rating method, procedures of evaluating a guarantee application would be: (i) To get and review the evaluation results from the institution responsible for the Construction Firm Grading (focus on "technical capabilities"); (ii) To Review the evaluation results from a bank who asks for a guarantee (focus on "financial indexes" and "percent of guarantee"); (iii) To inspect the required documents and JCIC credit scores submitted by the applicant (focus on "credit information" of the proprietor and the firm); (iv) To evaluate the project risk by the proposed Project Credit Scoring Model; and (v) To sum the above scores of every evaluation procedure, and, according to the summation result, to decide the guarantee amount, percentage of guarantee/loan, and the rate of charge. In the future, banks and SMEG will not depend heavily on the 5P principles (i.e., People, Purpose, Payment, Protection and Perspective).

The four credit rating or scoring methods are shortly introduced as follows. To implement the CGS, some ideas about improvement or adjustment of these methods are suggested in this paper.

7.1 The Construction Firm Grading by the Construction Law

The purpose of the Construction Firm Grading is to periodically realize the business management situation of a construction firm. The evaluation result is used to upgrade or downgrade a firm. If the firm is upgrades it may get awards, but if downgraded it may not join the public works. Hence, the national construction quality can be assured.

According to the Construction Law, there are six evaluation items listed in Table 2. Every item has one to four evaluation indexes. There are two acceptance standards of every item, A and B. If four or more items get the "A", the firm is the First grade; if three or more items get the "B", the Second grade; and the others, the Third grade. The Third-graded firm is not allowed to join the public works. Besides, there is an Excellent grade, awarded to the First-graded firm who passes the more rigorous evaluation standard (the Construction Quality item must be over the standard). The Excellent firm may pay half the amount of bid bond or performance bond when participating in the public works.

Table 2. The construction firm grading evaluation items and indexes [3]

Evaluation Item	Evaluation Index
1.Construction Projects Completion	The amount of all completed construction projects within 3 years.
2.Construction Quality	• Good Quality Ratio of all completed construction projects within 3 years. • Good quality award(s) awarded within 3 years.
3.Personnel Composition	• Construction Personnel Ratio • Personnel with Technical Licenses Ratio • Financial & Accounting Personnel Ratio
4.Management Ability	• No serious injury and death accident due to construction within 3 years • Delay Ratio of all completed construction projects within 3 years
5.R&D	The expenditure of research and development on technique and methods
6.Financial Position※	• Equity Ratio • Current Ratio • Equity • Debt Ratio

To consider the economy and timeliness, the financial position only includes financial structure. The reason is that the amount of a construction project is huge. Hence, evaluating the equity ratio of the firm is critical. The question is that, however, the Financial Position item is not required to get the "A". Then evaluating the financial position is just symbolic. Next, the evaluation work of the Construction Firm Grading is committed to several institutions. Every institution may have different criteria. Besides, the evaluation result of every item is not published so the grade seems to be a reference. A bank cannot directly use the "rough" grade. Therefore, these three problems have to be improved.

Another suggestion is that the evaluation result of every index should be quantified so even if two firms get the same grade their difference of technical capabilities and experience can be clearly identified. If so, the construction-specific CGS will be able to use the Construction Firm Grading as a credit rating method.

7.2 The Enterprise Credit Rating of the Banking Association

The banking association in Taiwan publishes a modified Enterprise Credit Rating Table, which includes three evaluation items with 20 evaluation indexes. Every item and index has its own weight. The bank gives a score for every index when evaluating an application. Calculating and summing the weighted credit score of every index, the result (total score) can be used to identify the risk by the Table. It is convenient for banks to evaluate risk.

Three items of the Table are Financial Position, Business Management, and Business Perspective. To small-medium enterprises, the weights of the three items are 40%, 40% and 20%, respectively. As to indexes of every item are as follows: [4]

- Financial Position: there are 10 indexes listed in Table 3. It is compared with the same item of the Construction Firm Grading method.

Table 3. Comparison of financial position between the Enterprise Credit Rating and the Construction Firm Grading

Indexes	Enterprise Credit Rating	Construction Firm Grading
Short-Term Liquidity	Current Ratio Quick Ratio	Current Ratio
Financial Structure	Debt Ratio (L-T Liab.+ SE)/FA Ratio	Equity Debt Ratio Equity Ratio
Profitability	Financial Fee Ratio Pre-Tax Income Ratio Net Profit Margin	–
Operation Performance	Inventory Turnover Ratio Accounts Receivable Turnover Ratio Total Asset Turnover Ratio	–

- Business Management: six indexes are Proprietor's General Credit Rating, Proprietor's Experience, Formation of Shareholders, Average Income Increase within three years, Capital Increase within 3 years, and Interactive Credit Position with Banks.
- Business Perspective: four indexes are Equipment and Technical Capabilities, Product Marketability, Ability to Provide Surety, and Perspective of the Industry in the next year.

If the construction-specific CGS adopts the Enterprise Credit Rating method, some suggestions need to be seriously considered. First, the weight of every evaluation index (especially the Financial Position item) should be adjusted according to the properties of construction industry. Second, two indexes of Business Perspective (i.e,Product Marketability and Perspective of the Industry) should be omitted.

7.3 The Credit Condition Evaluation of SMEG

The Small and Medium Enterprise Credit Guarantee Fund of Taiwan (SMEG) provides a guarantee when a small-medium firm has no enough surety and assists the firm to get a loan from a bank. Certainly, SMEG does not evaluate an application according to the rules set by the banks and their association. The credit conditions evaluated by SMEG can be divided into two aspects as following.

- Financial aspect: Financial Position (Short-Term Liquidity, Profitability, Financial Structure, and Operation Performance), and Ratio of Loans/Incomes ;
- Non-financial aspect: Clearing Credit, Debt-Paying Record, Relational Enterprises, Operating Team, Industrial Perspective, R&D Situation, Intangible Assets, and Other Credit Related Factors.

In these conditions, more special are Ratio of Loans/Incomes, Clearing Credit, R&D Situation and Intangible Assets. Besides, SMEG evaluates the risk according to the guarantee percentage of a loan which the bank asks and decides the rate of charge according to the credit conditions. The construction-specific CGS can reference these evaluation conditions in the Method.

7.4 The Construction Industry Model of JCIC

The Joint Credit Information Center (JCIC) collects credit information related to enterprises and their proprietors. The scope of its collection work includes the construction industry. The Information can be divided into four classifications and every classification has its own contents as listed in Table 4. The information can assist any bank to evaluate the credit risk of an enterprise. Especially to small-medium enterprises, the information of JCIC accounts for higher ratio of required data for credit risk evaluation. Hence, the information transparency of a small-medium enterprise rises up with the information provided by JCIC.

Besides, JCIC started to establish enterprise credit scoring models for different industries a few years ago. Generally, the models can be divided into three groups: for large enterprises, for medium ones, and for small ones. One of the models, called Construction Industry Model, is for the small-medium construction firms and is established according to the credit applications within the last year. The construction-specific CGS can also use the Model to evaluate credit risk.

Table 4. JCIC enterprise's credit information classifications and contents [5]

Information Classifications	Information Contents
Enterprise's Properties	The enterprise's name, VAT number, industry classification, formation, operating situation, capital magnitude, registration year, etc.
Enterprise's Credit	Total mount, types and change of debt; payment record; query record; number of interactive banks and accounts; length of credit history, etc.
Enterprise's Finance	Evaluate the enterprise's financial information of debt, liquidity, profitability, and operation performance, including original accounting items and 45 important calculated financial ratios
Proprietor's Credit	Name, I.D. number; enterprise's name, VAT number of the proprietor; personal credit record, personal credit scoring

7.5 The Required Documents of Project Financing

Chen [6] proposed that the Engineering Consultancy industry should submit the required documents of four groups when an engineering consultant firm applies for a loan. Three of the groups are listed in Table 5, and the other, the Surety Statement, can be omitted because there is no fixed document and form. The project required documents of the three groups are adapted especially for the construction-specific CGS as Table 5. The main added documents are Construction Firm Grading results, Construction Manager's information, Project Risk Analysis. With these documents, the project credit risk can be evaluated and controlled more easily

Table 5. Adapted required documents list of project financing [6]

	Group Name	Project Required Documents
Group1	Financial Statement	Estimated cash flow sheet
Group 2	Firm's Capabilities Statement	Firm's business history record, with construction firm grading result, awards, Excellent-graded firm, etc.
Group 3	Project Statement	Construction schedule, agreements, construction plans, construction manager's information, project risk analysis, project performance checkpoint and method, etc.

8. PROTOTYPE OF CONSTRUCTION PROJECT CREDIT SCORING MODEL

A "credit scoring model" is a kind of traditional quantified credit risk model. By the model, a bank can input values of the characteristic variables (e.g., financial indexes of a borrower) and calculate the result of default probability. The result (a score) represents the borrower's credit risk and can be classified to a certain grade. Accordingly, the bank considers how to manage the risk.

The concept of a "credit scoring model" is right fit for a project. The banks and the construction-specific CGS should establish such a model so the risk of a construction project can be quantified and its grade identified. Thus, this paper proposes a Construction Project Credit Scoring Model (or called Project Financing Risk Evaluation Model). However, only a prototype of the Model, the possible important factors on financing for Construction Industry and the better method how to establish the Model are presented in this paper.

8.1 Establishment Method of the Construction Project Credit Scoring Model

According to Chang [7], to establish a statistical model requires to collect several representative financial indexes of an enterprise (e.g., current ratio, debt ratio) as "independent variables" and the consequence of default or not as a "dependent variable". The statistical scoring models used more often by scholars and the industry can be classified into three types: Multivariate Discriminant Analysis, Logistic Regression Analysis and Neural Network Analysis. The last analysis, according to empirical study, has the advantages of higher prediction accuracy, no limit of the assumption that samples are normally distributed, and ability to deal with nonlinear questions, etc. Hence, there are more and more models established by the Neural Network Analysis. However, the problem of over-fitting should be noticed.

Under considerations of the nonlinear relationship of important factors on financing and the consequence of success or not for a construction project, the Project Credit Scoring Model is established by the Neural Network Analysis. The prototype of the Model may be a feed-forward, back propagation neural network as Fig. 2. To decide the number of input parameters, output parameters, and hidden layers of the Model, an empirical study is needed to conduct. Once the modeling job is finished, the CGS can evaluate project risk quickly with a credit score from the Model.

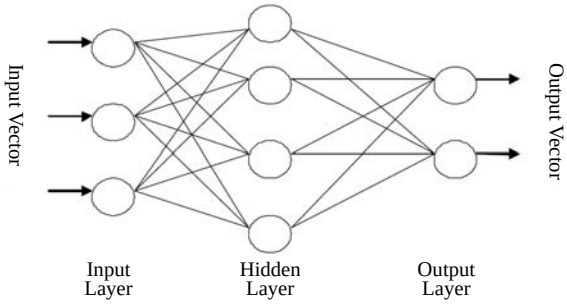

Fig. 2. An example of feed-forward, back propagation neural network with single hidden layer

8.2 Important Factors on Financing for a Construction Project

Before the modeling job, it is necessary to identify all possible factors of a construction project that may influence on financing. Then use the Neural Network Analysis method to find out the more important factors as the input parameters of the Model. Thus, this research attempts to collect the possible factors on financing for a construction project, especially focused on small-medium sized firms.

Chen [6] proposed 14 important factors that may influence on financing of the Engineering Consultancy industry. These factors are listed in Table 6 and further divided into two groups. The factors can be a reference for the construction industry due to many similar properties between these two industries.

Table 6. Important factors on financing of the Engineering Consultancy industry [6]

General Enterprise Information	Engineering Information
• Cash requirement statement • Firm's Financial Position • Incomes • Reputation • Loaning credit record • Debt-paying source statement • Surety • Form of the Surety	•Contract Conditions •Project scale and time •Amount and payment times of a loan •Cash flow statement •Concept of fixed debt-paying with progress payments •Governmental policy of reward and subsidy

This paper proposes more detailed factors that may affect the execution of a construction project or cause its financing failure. These factors are listed in Table 7. A thorough study is needed to inspect their effectiveness and to identify if there are other required factors.

Table 7. Important factors on financing of the construction industry

Type	Factors	Descriptions
Engineering Information	Type	•Civil engi. , buildings, bridges, …
	Properties	•Super- or sub-structure, tunnel, the height of a building, …
	Complexity	•Single or multiple works, …
	Technique Maturity	•Traditional or innovative?
	Duration	•Over one year?
	Site	•Geography, quake, weather, etc.
Project Information	Delivery method	•Traditional , D/B, Turnkey orBOT
	Tendering Situation	•Times of tendering failure
	Price Variation	•During price varying largely?
	Contract Conditions	•Reasonable Conditions?
Project Team Information	Owner's Properties	•Local government agency? management skills, budget, …
	Constr. Manager	•Experience, licenses, background
	Constr. Personnel	•Expertise, licenses, composition, background, …
	Supervisor/PCM	•Experience, licenses, background
Others	Government Policy	•Postpone or accelerate the project schedule, compensation, subsidy..
	Dispute Resolutions	•Owner 's attitude: elastic/ hard? Contractor's attitude: obey/defer?

9. CONCLUSIONS

This paper describes the influence of government procurement system on a construction firm's cash flow, financing problems of Taiwan's construction industry, the status quo of credit guarantee for construction firms by SMEG (an guarantee institution), and key factors of financing between construction firms and banks. In summary, small-medium sized construction firms usually have difficulty in loaning, and establishing a construction industry credit guarantee system (CGS) to assist the firms is necessary and imminent.

Through this research, the five ideal operating schemes of construction-specific CGS are proposed. Comparing the aspects of required capital, operating cost, professional personnel, cooperative banks, operation efficiency, and guarantee services, the suggested scheme is that the CGS is operated by SMEG with funds from both the Government and SMEG. Next, this paper recommends a composite credit rating method and procedures for the CGS which can evaluate guarantee applications more reasonably and control risk of the CGS effectively. The composite method combines the Construction Firm Grading by the Construction Law, the Enterprise Credit Rating of the Banking Association, the Credit Condition Evaluation of SMEG, and the Credit Scoring Model of JCIC. Also, a new Construction Project Credit Scoring Model should be included in the recommended method.

As to the Construction Project Credit Scoring Model, this paper proposes a prototype which is established by the Artificial Neuron Network method. To decide the number of input parameters, output parameters, and hidden layers of the Model, an empirical study on important factors of influencing project financing for a construction firm is needed to conduct. Once the modeling job is finished, the CGS can evaluate project risk quickly with a credit score from the Model.

Besides, most credit guarantee institutions have related measures of financial assistance or business management guidance. These measures apparently can not only improve financial management of small-medium enterprises, but also reduce the risk that credit guarantee institutions have to take. Hence, except for the construction-specific CGS, the government should consider these related measures. The concept of credit insurance from the Japanese Finance Corporation for Small and Medium Enterprises is worthy of considerations because such an insurance can help share the risk of a credit guarantee institution.

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