

Subcontractor Bankruptcy Risk Monitoring System Based on Credit Information

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Abstract: Contractors are vulnerable to bankruptcy or financial risk due to discontinuous orders, the economic recession and restructuring of construction industry. Therefore, general contractors have been straining to predict subcontractor's financial risk based on credit information during tendering. This research aimed at developing the subcontractor bankruptcy risk index set based on subcontractor's credit rating with overdue information. And studied the current subcontractor's bankruptcy risk management conducted by general contractors, correlation analysis between short-term overdue and bankruptcy of subcontractor and produced the bankruptcy risk monitoring model based on short term overdue condition. Case study was conducted to compare new model with current model serviced by credit rating agency and showed how accurately this system containing short-term delinquency information can be applied to default of subcontractors. When applying for the pre-alarm system, it is possible to grasp the bankruptcy of suppliers in the on-site field at least 30 days before the bidding process. In addition, the system can be used independently or in conjunction with the existing procurement system, so it can be applied irrespective of the construction company size and procurement system. The study results could be applied to SRM (Supplier Relationship Management) or subcontractor management system of general contractors and support timely monitoring of subcontractor's financial risk for reducing bankruptcy rate.

Key words: Supply chain, subcontractor, partnership, bankruptcy, risk, credit information

INTRODUCTION

The construction industry is heavily influenced by the economic situation. At the last recession and restructuring of the construction industry, the debt-to-equity ratio of the construction industry increased sharply from 149% in 2004 to 219% in the first half of 2009 (Anonymous, 2010). In the global recession years, the risk of default by small and medium-sized construction companies had been higher than ever due to a decline in the construction industry. In 2010, construction orders fell from 6.4% in the first quarter to 9.3% in the second quarter while the construction business BSI (Business Survey Index) stood at 70 in July and 74 in July (KDI, 2010). Then, the massive bankruptcy of small business partners was occurred at South Korea.

In the event of a mid-sized construction company failure, a large number of sub-contractors are also at risk of a series of defaults. In order to succeed in the construction project, it is necessary to select excellent suppliers and to recognize the bankruptcy of contractors participating in on-going construction projects.

In the case of the construction industry, 99% of all construction companies have difficulties in managing supply chain because the small and medium-sized contractors are currently managing the partner by hand. In other words, only about 1% of Korean builders use e-Procurement systems to manage and procure suppliers (Eom *et al.*, 2015). In addition, since the financial credit score information (financial statement-based cash flow rating, transaction risk index, etc.) provided by common credit rating agencies is past data at least six months ago which is six months ago, it is impossible to forecast the bankruptcy of suppliers in real time.

If a subcontractor falls into bankruptcy, major contractor in connection is inevitably affected by massive damages such as billing for construction execution guarantees, selection of follow-up companies, delayed pay for laborers and schedule delays. General contractors have been struggling to limit the entry of new suppliers who have risk of insolvency and to identify signs of partner bankruptcy on progress but they are hard to identify real-time default risks (Eom *et al.*, 2008). Therefore, this study examines the methods to grasp

the bankruptcy risk of the construction subcontractors and suggests the framework of the bankruptcy risk monitoring model.

Literature review

Current status of subcontractor management system:

Efficiency within the construction industry can be significantly improved by adopting information technology methods and solutions (Rankin *et al.*, 2006). e-Business can be defined as all business transactions (exchange of information) conducted electronically. Similarly, e-Commerce can be defined as all financial transactions conducted electronically (Schneider and Perry, 2000). Potential e-Commerce technology applications in the construction industry include e-Marketing, e-Selling, e-Procurement of goods and services, e-Collaboration, e-Finance and e-Customer services and relations (Veeramani *et al.*, 2002).

In the case of large general contractors, the supply chain network is established through its own electronic procurement system, partner selection and management are underway by this e-Procurement system. However, most small and medium-sized contractors depend on manual work for partner selection and management. It is difficult to select a company having excellent technology and financial status. In the construction industry, the market scale is expanding and the importance of partner management skill is increasing as a way to secure competitiveness of small and medium-sized subcontractors. However, companies that manage information systems by themselves are limited to large major contractor and it is difficult to evaluate the technical capability of suppliers, the reliability of the selection process is deteriorating due to the financial stability evaluation based on financial data a year ago and the secondary damage caused by bankruptcy during the performance of the business is serious.

In order to prevent bankruptcy of partnered subcontractor, it is important to identify stable condition that are free of default risk before bid participating. It is necessary to grasp the cash flows of suppliers in real time in the on-going construction site. At present, large-scale construction companies are making various efforts such as improving evaluation items, checking credit ratings, sharing bankruptcy companies and identifying problems to prevent bankruptcy of partner companies but it is difficult to grasp real-time defaults. More specifically, the selection of partner companies to be participated in bidding process and the periodic evaluation of partner's financial condition (Eom *et al.*, 2015). For this reason, it is mandatory for credit rating agencies to participate in the credit evaluation service at the expense of their suppliers.

Existing case: credit information system: Services related to this research include risk management solutions including Information Communication Technology (ICT) trading platforms (Alibaba.com, eBay, etc.), partner credit information (ecredible and cretop) and project management systems (Sang-ah management). The B2B trading platform is difficult to verify the reliability of the trading partner. The credit information solution is weak in providing real-time risk information and the accuracy of bankruptcy prediction is low. The project management system focuses on bulletin-oriented information exchange rather than large enterprise solution development or partner management (Sangchul and Tae-Hwa, 2016; Kim and Kim, 2011, 2012, 2014).

Alibaba.com:

- World's #1 B2B trading platform to provide worldwide supplier and buyer search
- However, it is difficult to verify the reliability of trading partners

Ecredible.co.kr:

- Closed operation based on credit information service, existing credit evaluation customers and large corporations (paid)
- The credit rating model uses the credit evaluation result of the previous fiscal year to provide real-time risk information
- Supplier management module is included but there is no recommendation and monitoring function of excellent suppliers

Cretop:

- Only corporations and individual operators are allowed to use
- Discomfort when individual wants to inquire company information (separate sales service for each case)
- Systematic recommendation, selection and monitoring of partner companies based on credit information provision

Sang-ah:

- Enables reduction in project term and cost and securing safety and quality by allowing all participants to follow scientific process
- Guarantees high efficiency in management and successful performance of designing and construction
- Improves capability and ensures competitiveness with systematic process and accumulated data

MATERIALS AND METHODS

Proposed work

System architecture: In order to grasp the default risk of a partner company in advance, various bankruptcy factors such as default, delinquency information, credit rating, delinquent transaction, suspicious transaction, credit grant inquiry record, debt, It is necessary to comprehensively analyze in Fig. 1.

The default risk model is constructed based on these risk factors and the default risk model alarm grade is calculated by observing, cautioning, risk, shutdown, closing and defaulting grade considering the risk factors.

Observe: Commerce delinquency information occurrence, Credit guarantee observation status, exceeding the recent inquiry record schedule, downgrading the rating.

Caution: Occurrence of non-payment of debt information (significant matters are classified as risk), the condition of credit granting, the occurrence of litigation information or more.

Danger: Korea Enterprise Data (KED) Model grade 'D' external debt/corporate note 'D'.

Closing and Close: National Tax Service (NTS).

Bankruptcy: Including promissory notes, checking drafts, household checks, etc.

The above precautions are possible for each risk level. Observation: preparing countermeasures such as analysis of causes and measures for each case (90~70 days ago), Attention: (50~30 days before), closure/closing/bankruptcy: confirmation of the bond (foreclosures, clogs) and additional loss confirmation.

Bankruptcy alarm model: In order to build the proposed system, the steps were taken as follows. Establishment of business pool and mutual evaluation system that can be mutually shared different from its own partner pool through process innovation process that is subject to benchmarking of current procurement system and management process of large and small business collaboration.

Consider risk management function that can work with Short Message Service (SMS) and Social Networking Service (SNS).

Establishment of partner management system that can be easily accessed by of Small and Medium-sized (SMEs) company, User Interface (UI) development available and company search.

Applying and testing the implemented partner management system in the field, verifying its usability and standardizing core technologies so that it can be applied to various smart devices. Set up various commercialization measures, promote technology linkage or commercialization.

Short-term overdue information is essential to predict the possibility of contractor's bankruptcy-result of previous data analysis, about 40% of corporations with overdue of 15 days or less have defaulted and 55% of corporations with overdue of 30 days or less have defaulted.

The research team built a web/mobile-based vendor inquiry/registration/management and transaction risk monitoring system that can be easily used by SMEs. The core credit evaluation module is to provide the integrated transaction risk indicator and the recommendation function of the excellent company by constructing a series of bankruptcy indicators (network) based on the Korea Enterprise Data (KED) credit rating information in Fig. 2.

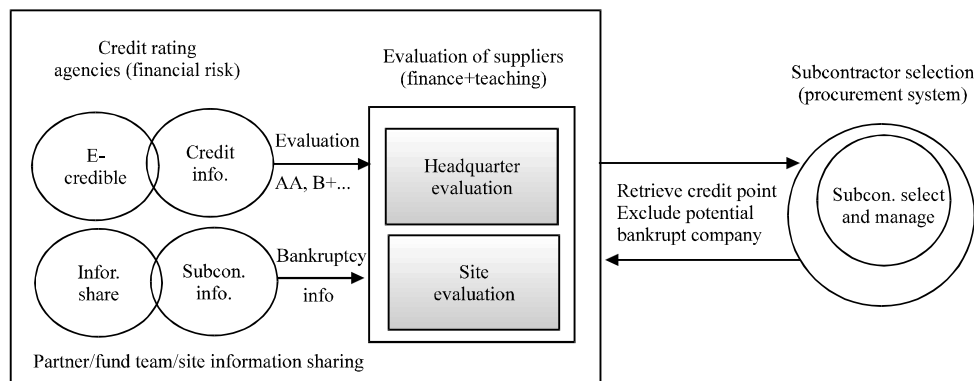


Fig. 1: System architecture of bankruptcy alarm system

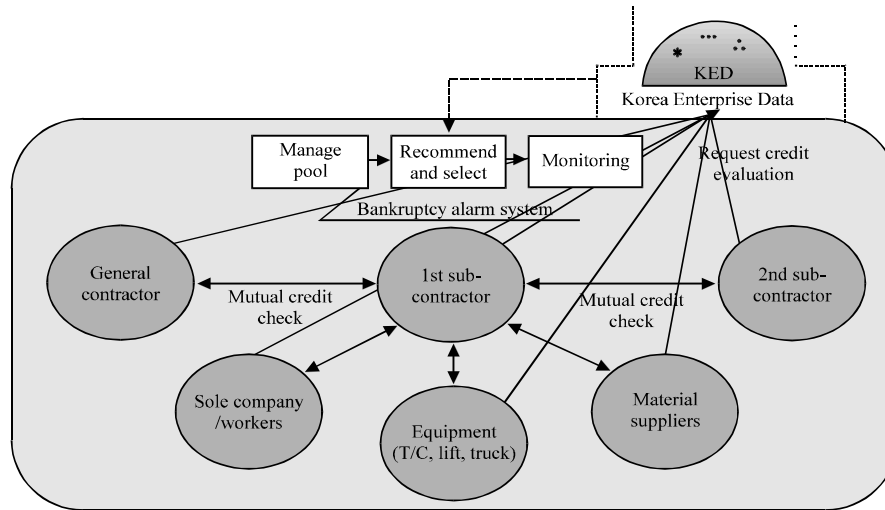


Fig. 2: Proposed bankruptcy alarm system data flow

RESULTS AND DISCUSSION

System functions

Partner information screen: Users can get your partner's risk index and can follow detailed information on the right. Next, users can verify the license information and the evaluation table for the contact information company.

Network type of partner monitoring: In the network type, it is possible to check the fluctuation information. In the interruption layer, it is possible to check the information by category such as order by transaction weight.

List of partner monitoring pages: Classification and Credit Rating (CR), Cash Flow (CF), Early Warning EW) and Network Risk Index (NRI) scores in a list format, it is configured to use the function to sort the list by scale and risk.

Results and achievements: Through the proposed system, the results were summarized as follows: Development of risk management-based collaboration system (Biz check) for small and medium enterprises. Business through financial risk management including credit information, short-term delinquency information and chain bankruptcy prediction.

Develop partner collaboration and risk management systems to evaluate and deliver partner's sustainability. Established in conjunction with credit DB-based cash flow rating and short-term delinquency information system, Korea Enterprise Data (www.kedkorea.com), a specialized agency for credit evaluation of SMEs.

The search and inquiry of the subcontracted subcontractors will be made according to the category of the construction industry and the best companies according to the category/area/scale will be sorted by the ranking.

The algorithm for selecting the best subcontractor will be based on the credit information, technical information and performance-based evaluation model. Benchmarking of current procurement system and processes for large and small business collaboration management process establishment of company pool and mutual evaluation system that can be mutually shared through innovation research.

Additionally, the proposed system's achievements were founded as follows: Through the time series analysis, the default rate of the new method compared to the existing method (the actual number of bankruptcies/bankruptcy predicted among the target firms) increased from 3.2-11.4%.

The credit information provided by existing credit rating agencies is not predictable due to past data (financial statement-based cash flow rating, trading risk index, etc.) six months ago, however, the short-term delinquency information to be applied to the proposed system is estimated to be 40% for overdue corporate debts of 15 days or less and about 60% for overdue delinquencies of 30 days or less.

CONCLUSION

As the risk of bankruptcy of partner companies increases, construction companies are making various efforts such as strengthening financial information inquiry

centered on credit ratings and cash flow ratings in selecting and managing companies but they are struggling in terms of timely identification of default risk precaution. Therefore, this study examines the methods to grasp the default risk of the construction company partners and presents the case of the default risk prediction model and the pre-alarm system based on the short-term delinquency information closely related to the default rate.

When applying for the pre-alarm system, it is possible to grasp the bankruptcy of suppliers in the on-site field at least 30 days before the bidding process. In addition, the system can be used independently or in conjunction with the existing procurement system, so it can be applied irrespective of the construction company size and procurement system.

At the same time, it is important for builders to form a solid partnership with excellent partners in the long term. The research team improved evaluation indexes of existing partner companies to evaluate real-time cash flow, transaction risk index, It is necessary. In addition, credit rating agencies should support the development of a trading risk index using short-term delinquency information of the financial sector, check the paper company through on-site inspection and reflect the credit rating in real-time.

Additionally, the proposed system can make social positive effects. Search and selection of transparent companies, elimination of insolvent companies and risk management improved productivity by eliminating wastage/inefficiency throughout the industry eliminate default risk by real-time understanding of partner technology/financial status and advance into mobile application market with project management technology.

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