Characteristics of Industry Structure and Problems with the Bidding and Contracting System in Japan's Rural Construction Industry

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Abstract

This study analyzes the characteristics of Japan's industry structure for rural construction and exposes problems with the current bidding and contracting system for public works projects. Analysis of financial data from 266 construction companies and questionnaire responses from 52 companies in Fukushima Prefecture shows that the comprehensive evaluation method of the current bidding and contracting system does not function adequately and opportunities exist for market oligopoly. Moreover, the study finds that Japan's rural construction industry has a high degree of information sharing, resulting from a complex, layered subcontracting structure. These results indicate the need for a detailed analysis of industry structure when designing systems for rural construction industry regulation.

Keywords: Japan's industry structure for rural construction, bidding system, market failure, soft information

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Data Availability: The data used in this study are not publicly available.

1. Introduction

Due to its historical background, Japan's rural construction industry has an industry structure that differs from that of the major general contractors and engages in business practices all of its own. This study analyzes the characteristics of Japan's industry structure for rural construction and exposes problems with the current bidding and contracting system for public works projects.

In many municipalities, bidding on public works projects has traditionally taken the form of designated competitive bidding systems in which project initiators designate desired bidding contractors according to determinations of their capabilities and credibility.[1] In recent years, however, there has been a significant institutional shift from a system based on designated competitive bidding to one based on public bidding, a result of reduced government investment in construction and desired transparency after several bid-rigging scandals were uncovered.[2] This institutional shift has led to fewer bid-rigging cases, but the resulting intensification of price competition has raised new problems, such as the frequent occurrence of orders at levels close to what could be termed "dumping." In response to this, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) began promoting as an anti-dumping measure the introduction of a

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[1] In Japan, according to the Public Accounting Act, government procurement projects are generally required to use public bidding procedures. When certain conditions are met, however, designated competitive bidding is permitted.

[2] As shown below, public investment in recent years has declined sharply in Japan. As a result, as compared to public investment, the number of construction companies has become excessive. In response to this situation, for the purpose of restructuring and selection of construction companies, the Japanese government has been promoting reform of the bidding system.

comprehensive evaluation method for general competitive bidding, and many municipal governments have implemented such measures with the goal of mitigating competition based only on price. It is difficult to say, however, that the implementation of such schemes has always resulted in increased levels of social welfare in Japan's rural areas. As will be described, there are indications that the introduction of comprehensive evaluation methods by local governments for public works project bidding has resulted in oligopolistic situations which negatively impact on economic efficiency.

This study examines Fukushima Prefecture's transformation from using a designated competitive bidding system to a general competitive bidding system in 2007, one year after the uncovering of a bid-rigging scandal there. The results of this analysis are then used to describe the characteristics of Japan's rural construction industry and indicate potential market failures in the Japanese bidding system.

2. Environment and management conditions surrounding the construction industry in Fukushima Prefecture

Table 1 shows changes in construction investment as reported by MLIT (figures given for fiscal 2009 and 2010 are tentative). As is evident from the table, there was a marked reduction in both public and private construction investment for the period 2000–2010. While not shown by the table, figures indicate that construction investment levels in recent years are approximately half that of their 1992 peak value of 84 trillion yen.

Table 1- Changes in construction investment

Notes:

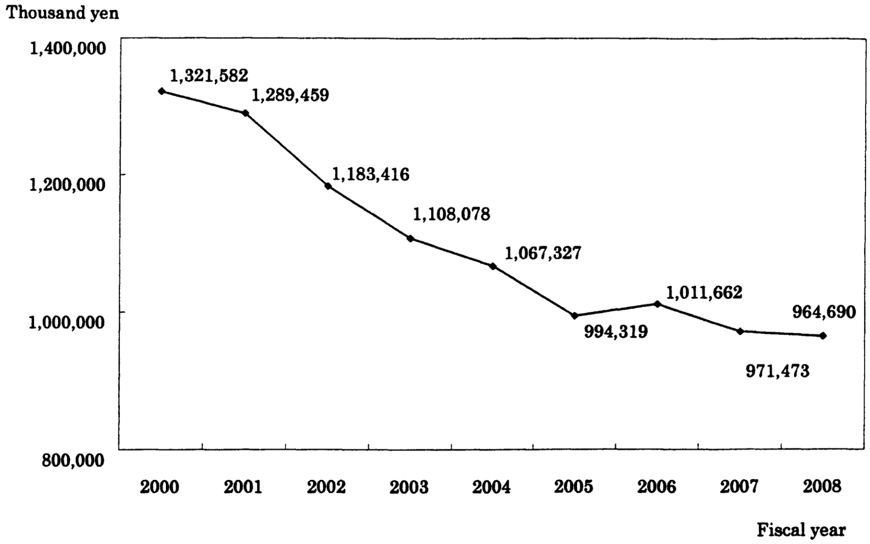
Fiscal year	2000	2005	2006	2007	2008	2009 (Tentative)	2010 (Tentative)
Nominal CI	66,195	51,568	51,329	47,696	48,151	42,400	41,130
(Increase rate)	-3.4%	-2.4%	-0.5%	-7.1%	1.0%	-11.9%	-3.0%
Nominal Government CI	29,960	18,974	17,797	16,946	16,717	17,370	16,580
(increase rate)	-6.2%	-8.9%	-6.2%	-4.8%	-1.3%	3.9%	-4.5%
Nominal private CI	20,276	18,426	18,750	16,602	16,387	12,840	12,430
(Increase rate)	-2.2%	0.3%	1.8%	-11.5%	-1.3%	-21.6%	-3.2%
Nominal private NH CI	15,959	14,170	14,782	14,147	15,047	12,190	12,120
(Increase rate)	0.7%	4.0%	4.3%	-4.3%	6.4%	-19.0%	-0.2%

1. CI: construction investment

2. Private NH CI= private non-housing construction investment + private civil engineering investment

Source: Research Institute of Construction and Economy (2010).

Figure 1- Changes in average order volume per company among construction companies in Fukushima Prefecture (general constructor basis)



Source: Fukushima Construction Industry Association (2009).

Figure 1 shows changes in average order volume per company among corporate members of the Fukushima Construction Industry Association.[3] Here, too, a significant decline can be seen in average order volumes since fiscal 2000. According to the *Q&A Handbook for Improved Management of Small- and Mid-Sized Construction Firms* (Council on Construction Industry Management 2009), as of fiscal 2007, the share of public investment in construction projects in the Tohoku region[4] was 44.5%, which is significantly higher than the share in urban districts such as the Tokyo area.[5] In the Tohoku region, changes in construction investment by central and local governments have considerably impacted the annual order volume for individual construction companies, and hence, financial conditions in the region. Given that the amounts of public investment in Japan are not expected to increase significantly in the foreseeable future, such allocations are a major influence not only on the operations of individual construction companies, but also on the structure of the entire rural construction industry in the Tohoku region and beyond.

In a 2007 survey of construction companies, Okumoto (2008) noted some common themes in the respondents' comments about conditions surrounding the construction industry in Japan: 1) sales had sharply dropped since their peak in around 2000, making financial conditions severe; 2) *kyoryoku kai*[6]

[3] The values given are for corporate members of the Fukushima Construction Industry Association. The Association had 266 members as of 2008.

[4] Tohoku region is the northeast region of Japan within which Fukushima Prefecture lies.

[5] In comparison, the same-year ratios for the Tokyo and Osaka areas were 20.2% and 25.9%, respectively, approximately half that of the Tohoku region.

[6] One characteristic of the Japanese construction industry is the formation of a multilevel structure made up of primary and secondary subcontractors beneath the prime contractor that receives a public works project. Such networks also contain companies that specialize in specific areas of construction, such as electrical installations. These networks of companies go under the name *kyoryoku kai*.

supplier associations were formally dissolving or were in danger of failing; and 3) the number of employees was decreasing, leading to a reduction in scale. These comments reflect the harsh economic environment in which the construction industry operates in Fukushima Prefecture (Okumoto 2008, 17).

Adding to this situation, a bid-rigging scandal that was unearthed in Fukushima Prefecture in 2006 led to major reforms, including the introduction in 2007 of a general competitive bidding system to replace the previous traditional system of designated competitive bidding. While such reforms clearly have merits such as preventing bid-rigging deals and improving competition and transparency, they have also introduced new problems, including 1) unqualified contractors participating in bids, 2) an increase in extremely frequent bids in excess of actual management potential, and 3) "dumping"-priced bids designed to fix cash-flow problems. This last problem, in particular, has led to an intense price war within the Fukushima Prefecture construction industry, to the extent that even companies that were, relatively speaking, previously financially healthy are now weakening.[7]

3. Introduction of the general competitive bid system and its results

3.1 Failures of the general competitive bid system

As described above, in the case of Fukushima Prefecture, the introduction of a general competitive bidding system alone was not sufficient to optimize resource allocation through free competition, or to provide improvements in the quality of the industry overall or in the goods and services that it provides. It is tempting to view this as a functional failure of auction mechanisms, but there is one problem with this analysis: the structure and characteristics of the construction industry in Fukushima Prefecture, as well as the characteristics of the goods and services provided by builders there, may not be suited to the auction mechanisms introduced in 2007 or, at the very least, may not yet have matured to a point where they are suited.

The auction system which Fukushima Prefecture introduced in 2007 can be thought of as a first-price sealed-bid auction (FSA). And the aim of this introduction can be thought of as to prevent involvement in bid-rigging.[8] However a variety of conditions must be met in order for FSA mechanisms to perform efficiently in a market. These conditions are related to factors such as the characteristics of economic agents participating in the auction and traded goods or services, information levels during transactions, attributes of a deal, and so on. When analyzing the construction industry in Fukushima Prefecture with such factors in mind, several instances of dysfunctional FSA mechanisms become apparent. As one previously noted example, the ratio of public works to total construction investment is quite large in the Tohoku region. This study, therefore, focuses on public works construction ordered by public entities.

Okumoto (2008) presents some interesting findings related to companies participating in the construction market and to the construction industry itself. In particular, 1) there are too many companies in the industry,[9] 2) there is no clear differentiation in the characteristics of enterprises (category of business, management practices, etc.), 3) there is a need for improvements in management quality in the

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[7] Okumoto (2008) reports that almost all companies in the Fukushima Prefecture construction industry mentioned these problems in interviews.

[8] As shown by Vickrey (1961), factors related to top bid, individual rationality, and strategy-proofness suggest implementation of second-price sealed-bid auction rules. However, this approach, too, leads to problems. For one thing, the bidding prices presented by construction companies are roughly equivalent to the company's cost information, which removes the incentive for an honest presentation due to the highly sensitive nature of the information. Furthermore, the probability of collusion is higher under such rules than under FSA.

[9] In 2007, the number of construction companies in Japan was 600,980, which was 462 companies per 100,000 people. The number of construction companies in Fukushima Prefecture was 9,788, which was 489 companies per 100,000 people.

industry as a whole, and 4) there is a significant difference in attitude between general contractors and subcontractors. It is possible to uncover which FSA mechanisms have become factors in the price wars in the rural construction industry by keeping in mind not only these characteristics of construction firms participating in the auction and their industry structure, but also the nature of public works as a consumed good, as well as the relationship between the prefectural and other local government bodies who order public works and the local residents who are, in the end, the final consumers of the product.

FSA mechanisms do not function effectively, primarily because construction companies participating in auctions are heterogeneous, and company managers have high levels of risk aversion. Risk-averse bidders fear losing bids, and so submit lower bids than they normally would (Milgrom and Weber 1982). Disparity between bidders heightens this effect, creating even lower bids as the number of bidders increases.

Bid ratios, the ratio of the accepted bid versus the budget originally proposed, are another factor in the auction process. Iwamatsu and Endo (2008) analyze bidding results data from April 2005 through July 2007, and show that an increased number of bidders resulted in a tendency for a lower bid ratio. This does not present a problem in the case where such decreases in bid ratios result from competitive pricing, thus leading to increased economic efficiency. In Fukushima Prefecture, however, the situation is not necessarily associated with increased economic efficiency, but rather with a tendency toward "dumping." This tendency is further enhanced by the following characteristics of public works revealed by the investigation of Okumoto (2008).

One characteristic of public works as goods is that, ideally, the local residents who serve as ultimate consumers of those goods should be reflected in their trade. However, in the case of rural public works, the end consumer is unable to influence price directly, so local government bodies with the ability to set prices serve as consumer representatives when placing orders. As a result, while builders should be interacting with the final consumers (local residents), it is possible that deals will be completed considering only those placing the orders.

A second characteristic is the asymmetric information between local government bodies and builders related to the product quality of the public works being traded. In auctions, the seller (or auctioneer) generally has perfect information related to the quality of the item for sale. However in public works bidding, local government bodies who conduct auctions have limited information about the quality of the products or builders. Moreover, information on public works created by the construction industry is often not fully revealed to the public, and, when it is provided, the information is of such a highly technical nature that end consumers are unable to differentiate among the public works or the builders providing them. In this sense, the rural public works market in Japan is what Akerlof (1970) refers to as a "lemons market." As indicated by Tirole (1986), however, there is an expectation that the governmental bodies placing orders as representatives of the end consumers will evaluate the relevant information and accurately assess the quality of the goods. Where those individuals placing the orders are unable to accurately assess the quality, however, there can be no guarantee of the quality of the goods. The result is competition based on price alone.[10]

There exists yet a third characteristic, which is related to the builder-supplied public works themselves. The most common form of public works projects ordered by local government bodies is that of general civil engineering construction. In most cases, the quality of such projects serves as the standard good, and there is little room for differentiation through the provision of added value. The result of this characteristic of public works as goods is that they are particularly prone to falling into competition based on price alone.

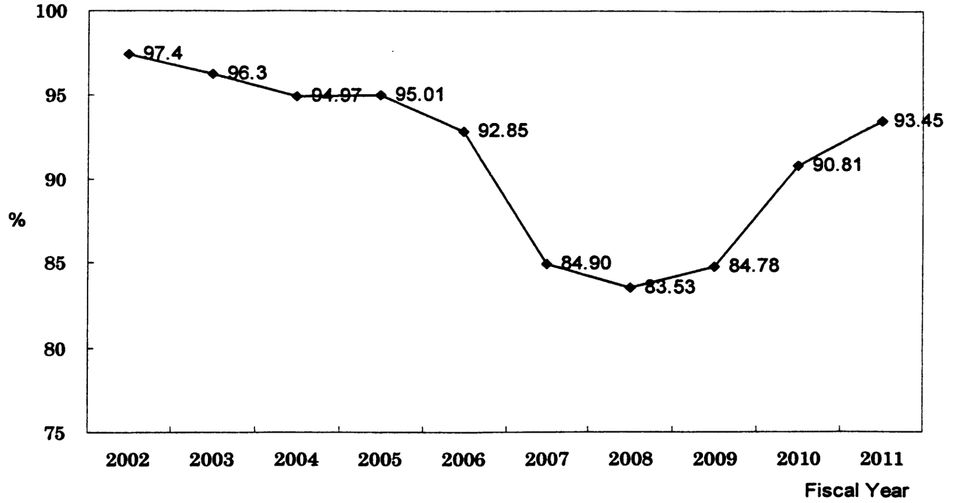
[10] Another possibility is that those placing the orders and those taking the orders will collude to set contracts at inappropriately high prices. This is exactly the scenario that led to price fixing problems and the resulting introduction of general competitive bidding.

This point means that even among otherwise similar construction companies, there is a significant difference between those who primarily take on private-sector construction projects and those who focus on general civil engineering projects. That is, the former are better able to perform price differentiation according to product quality in the form of added value according to the demands and tastes of the private sector, while the latter serve mainly to provide a standard good according to specifications and indicated price. Given this, the fact that there are differences between the two types of companies is not surprising. In the case of Fukushima Prefecture, differentiation is also seen based on differences in company scale and whether the company is a general contractor or subcontractor, even within the private-construction or civil engineering sectors, and this causes asymmetry among bidders. Another factor further strengthening this asymmetry is the multilayered subcontracting structure found in the rural construction industry. It has become common practice in the rural construction industry in Japan for general contractors to contract with local government bodies who place the order, but for subcontractors to perform all substantive construction work under the general contractors' supervision. Those subcontractors then hire secondary subcontractors, who in turn hire tertiary subcontractors, creating a somewhat unique system of production.

Okumoto (2008) shows that this multilayered structure has created a sense of differentiation between the general contractors and subcontractors. Specifically, general contractors see themselves as managers and coordinators of ordered construction projects, while subcontractors are treated only as a resource for getting work done. This means that in conventional bidding systems, subcontractors may underestimate the role of general contractors, thinking that they have the ability to successfully take on construction projects alone. In such cases, when both general contractors and subcontractors participate in competitive bidding without distinction between them, subcontractors will bid an amount that is less the margin taken by the general contractors. This is not a problem if the subcontractors have sufficient ability to take on and complete projects, but in cases where they provide low quality construction due to deficiencies in management and coordination, there can be a significant loss of social benefit. As previously described, there has recently been a dramatic decrease in the number of public works ordered, making the financial situation tight for many companies. This has especially been the case in the rural construction industry, and it is likely that the introduction of general competitive bidding systems has significantly contributed to such situations of adverse selection.

As noted by Iwamatsu and Endo (2008), there is a significant entry cost for construction companies participating in general competitive bidding, further increasing participants' risk averse behavior. Figure 2 shows changes in the bid ratio before and after the introduction of general competitive bidding; there is a clear decline following the introduction in 2007. The subsequent increase in the bid ratios, particularly in 2010 and later, is due to the decrease in the number of bidding participants.

Figure 2- Changes in the bid ratio in Fukushima Prefecture



Source: Fukushima Construction Industry Association (2009)

3.2 Introduction of the general competitive bidding system in Japan

According to The Central Construction Industry Committee (1998), MLIT set forth the following goals in 1998 in order to shift from the previous designated bidding system to a general competitive bidding system, and to "greatly increase transparency, objectivity, and competition, while decreasing dishonesty":

1. Introduce the tender and contract methods, which adequately evaluate the technical competence of the company, and promote market competition based on technical competence by the thorough elimination of defective and incompetent companies that hamper appropriate competition.
2. Change management style by focusing on not only quantitative aspects, but also qualitative aspects, and promote the development of a new style of enterprise by means such as enrichment of managerial and technical skills and the reorganization among the companies.
3. Create the desired competitive environment through changes such as progress in technical development, promotion of disclosure of the companies' additional information (including work performance and social responsibility), and improvement in the transparency of the tender and contract processes.
4. Promote rationalization of the production systems related to construction, including an increase in production and management efficiency, and improvement of prime contractor-subcontractor relations.

General competitive bidding systems were introduced by many rural governments in response to the goals listed above. However, in view of the characteristics of construction companies and market conditions described in the previous section, careful consideration of a more detailed system design might have been warranted. For example, the system design could have better insured functioning of the FSA mechanism by including needed subsystems to prevent a market failure, such as more sophisticated monitoring systems and information disclosure systems. Phenomena indicating the dysfunction of FSA mechanisms have arisen not only in Fukushima Prefecture, but also in other locales which introduced similar general competitive bidding systems.

Starting in 2005, such conditions led MLIT to push for the introduction of comprehensive evaluation methods as a way of improving the competitive conditions for bidding. This was largely triggered by the fact that the general competitive bidding systems as originally introduced relied too strongly on price as the competitive factor by which companies would be awarded public works jobs. Unlike commodities, public works have unique non-cost bases for quality evaluation, such as delivery date, completeness, durability after completion, and regional adaptation.

In auctions for goods or services having multiple attributes, scoring systems theoretically provide benefits. For example, Che (1993) showed that under scoring systems, the auction organizer (the seller) benefits from full disclosure of auction information, such as the designed method for calculating scores. It is likely that the introduction of comprehensive evaluation methods has come to be so strongly recommended in Japan on such a theoretical basis. This notion was formalized on April 1, 2005 with the Promotion of Quality in Public Works Act. In this way MLIT hoped to "preserve the quality of public works by 1) optimizing the bidding and contract process by eliminating unqualified builders as job recipients; 2) better utilize the abilities of private sector firms; 3) form fair contracts by placing all parties on equal footing during the contracting process; and 4) increase consideration of quality assurance in surveys and designs for public works" (MLIT 2005).

As a consequence, in 2006, Fukushima Prefecture introduced a comprehensive evaluation method for general competitive bidding related to public works. Even today, Fukushima continues to implement institutional changes, including revisions to the evaluation criteria, as a way of improving the system.

4. Analysis design and data

4.1 Analysis goals

This study is divided into two parts. The first part analyzes financial data from rural construction companies with headquarters in Fukushima Prefecture to investigate whether comprehensive evaluation methods are effectively functioning in general competitive bidding schemes there. The targets of this analysis are the business evaluation score (BES) developed during the business evaluation according to Article 27.23 of the Construction Business Act[11] when builders contract for public works.[12] The reason for this emphasis is the high weighting placed on BES as part of the overall score in the comprehensive evaluation. MLIT has publicized the standards applied to the evaluation items for the business evaluation, along with the weights assigned to each. This study intends to make more clear the structure and characteristics of the business evaluation through an analysis of actual corporate financial data.

The second part of the analysis examines tacit information retained within the construction industry (hereinafter, "soft" information[13]) in Fukushima Prefecture, and investigates how well such information corresponds with rankings made according to the business evaluation. The goal for performing such an analysis is described below.

If it were possible to use soft information from within the rural construction industry to explain company

[11] The Construction Business Act, established in 1949, is a Japanese major law pertaining to construction firms. In Japan a construction license as specified by this act is required by any person or company that intends to operate a construction business.

[12] When considering problems associated with comprehensive evaluation methods, it is essential to analyze not only these business evaluation scores (BES), but also the "subjective scores" set forth by individual local governments. This was not done in this study, however, due to limitations such as data availability; such analysis is left for future investigation.

[13] Here, "soft" information is as defined by Boot (2000), namely, information such as reputation and rumors present within the industry but normally impossible to obtain through public means. In contrast, publicly available financial information is referred to as "hard" information.

rankings according to the business evaluation, this would be indicative of the functional failure of blind auctions such as FSA. Under such conditions, when the companies placing a bid are made public and the industry is able to make accurate predictions as to which company will win, this can act as a barrier to bid participation by companies less likely to win. Increasing the number of companies taking part in the bidding process can lead to the selection of superior firms as well as bring about corporate growth by promoting competition between companies. When the number of participating firms is limited, however, this can lead to a de facto oligopoly under which the merits of competitive bidding systems are not realized. Of course, even in situations where rankings can be explained by soft information within the industry, if those factors by which rank is determined can be improved through efforts made by individual companies then this might promote such efforts, leading to industry growth. Many factors such as company scale and longevity, however, are part of the initial endowment of participating firms, making control through self-effort problematic. When such factors determine rank, companies may not only lose the will to participate in bidding, but may also feel a sense of unfairness that will sap their will to grow. In this study, a questionnaire and interview surveys were performed, during which many comments were heard that confirmed such feelings of unfairness. Therefore, those factors that can lead to such a situation were also verified.

4.2 Methods of analysis

In the primary analysis, multivariate analysis is performed on financial data from the 3-year period spanning fiscal 2006 through fiscal 2008 for 266 companies belonging to the Fukushima Construction Industry Association. The financial indices that form the business evaluation are summarized using principal component analysis and their characteristics are analyzed. Regression analysis is then carried out to determine to what extent the summarized data explain BES and to examine the explanatory power of the various categories of information.

In the secondary analysis, a questionnaire survey and interviews were completed with the 52 corporate members of the Fukushima Prefecture Construction Industry Cooperative.[14] The data obtained are then quantified and principal component analysis is performed in a similar manner to the primary analysis. Again, regression analysis is used to examine the explanatory power of the gathered data with regard to BES.

4.3 Results of the primary analysis

4.3.1 Data

As described above, financial indices for evaluation items X1, X2, and Y of the business evaluation are calculated based on financial data from the 266 companies belonging to the Fukushima Construction Industry Association. Table 2 shows the evaluated items and scores. Financial data was obtained from the Fukushima Construction Industry Association.

The business evaluation items were revised in 2008. MLIT (2008) describes the 2008 revisions as follows.

1. An evaluation of scale, including a balanced consideration of completed work amounts, profits, and capital stock (X1, X2)
2. An evaluation of financial conditions that accurately reflects company conditions (Y)
   • Includes 8 indices that allow evaluation of resistance to debt encumbrance, profitability and efficiency, financial health, and absolute competence
3. A more accurate evaluation of technological capability (Z)

[14] These companies are also members of Fukushima Construction Industry Association.

4. An evaluation that allows for differentiation according to fulfillment of social responsibility (W)

Table 2- Evaluation Criteria of the Business Evaluation

Weight		Evaluation items
0.25	X1	the amount of completed work
0.15	X2	net worth earnings before interest, taxes, depreciation and amortization
0.2	Y	net financial cost to sales ratio debt to sales ratio current profits to sales ratio gross profits to total assets ratio equity to fixed assets ratio equity to total assets ratio operating cash flow earned surplus
0.25	Z	the number of technical staffs construction revenue of principal contract
0.25	W	record of labor welfare conditions the number of years in business contribution to disaster prevention activities compliance accounting method research and development activity

In addition to the four revisions listed above, MLIT (2008) also stated that "the establishment of fair and realistic standards for evaluating firms engaging in public works will provide a 'yardstick'" by which to "measure and support the efforts of companies in improving productivity and management efficiency". One can take this as meaning that the goal of the revisions was to establish a more balanced standard of evaluations that relies less on completed work levels, and takes into consideration changes in business conditions and diversification of the construction industry. As part of the revision, BES is computed according to the Equation (1):

$$\text{Total BES } P = 0.25 * X1 + 0.15 * X2 + 0.2 * Y + 0.25 * Z + 0.15 * W \qquad (1)$$

As can be seen, weighting of the X1, X2, and Y terms in this equation means that these items account for 60% of the total score. This analysis uses data related to these evaluation items to determine if the assigned total scores are consistent with the intended goals of MLIT for revising the business evaluation. Note that the following data items are modified or omitted from the analysis for the reasons stated:

- EBITDA (earnings before interest, taxes, depreciation, and amortization) is replaced with net operating profits, due to the number of missing values related to depreciation
- current profits to sales ratio is replaced with operating profits to sales ratio, because data for the former are not available
- operational cash flow is omitted, due to the number of missing values
- earned surplus is omitted, due to the number of missing values

4.3.2 Results of principal component analysis 1

Due to the modifications described above, analysis of the 11 indices related to evaluation items X1, X2, and Y is performed using 9 indices. As can be seen in Table 3, these 9 indices are aggregated into 3 principal components with significant information.[15] These 3 principal components account for 68% of the total explained information. Table 3 shows the factor loadings for each variable.

The factor loadings presented in Table 3 can be interpreted as follows. Note that varimax rotation was performed to rotate the factor axes to allow for easier interpretation of the factor loadings.

Factor 1: This factor has a high positive correlation with net financial cost to sales ratio and debt to sales ratio, and high negative correlation with equity to fixed assets ratio and equity to total assets ratio, indicating reliance on debt. In this analysis, this is taken as a debt reliance index.

Factor 2: This factor has a high positive correlation with operating profits to sales ratio and gross profits to total assets ratio, marking this as a factor related to profitability. In this analysis, it is taken as a profitability index.

Factor 3: This factor has a high positive correlation with the amount of completed work and net worth, marking this as a factor related to scale characteristics. This is taken as a company scale index.

In summary, the X1, X2, and Y evaluation items, which account for approximately 60% of the information level contained within the business evaluation, are determined according to 1) whether the firm relies on debt (financial health), 2) whether the company is profitable (profitability), and 3) whether the company is large (company scale).

We next use regression analysis to investigate the extent to which these three indices explain the total score for the business evaluation, including the Z and W items.

Table 3- Results of principal components analysis 1

Eigenvalues and accounted for variance

Factor	Eigenvalue	Accounted for variance	Cumulative percentage of total variance
1	2.751	30.57	30.57
2	1.866	20.73	51.30
3	1.549	17.21	68.51

Factor loadings

Variables	Factor 1	Factor 2	Factor 3
The amount of completed work	0.0436	0.0855	0.8832**
Net worth	-0.1852	-0.0588	0.8495**
Operating income	0.0776	0.6065	0.4619
Net financial cost to sales ratio	0.7259**	-0.0325	-0.1529
Debt to sales ratio	0.8010**	-0.1890	0.0180
Operating profits to sales ratio	-0.1084	0.8394**	0.1860
Gross profits to total assets ratio	-0.0973	0.8706**	-0.1966
Equity to fixed assets ratio	-0.7214**	0.0191	0.0405
Equity to total assets ratio	-0.8481**	0.0332	0.0442

** indicates loadings > 0.7.

[15] We extracted the principal components with eigenvalues greater than 1.

4.3.3 Results of regression analysis 1

The analysis model is:[16]

$$\text{Total BES } P = \alpha + \beta_1 * \text{debt reliance index score} + \beta_2 * \text{profitability index score} + \beta_3 * \text{scale index score}$$

Tables 4 and 5 show the respective results of the BES regression based on principal component scores; Table 4 shows the results of regression of 2007 BES based on fiscal 2006 financial data, and Table 5 shows the results of regression of 2008 BES based on fiscal 2007 financial data. The coefficients of determination shown in Table 4 and Table 5 are 60.4% and 58.8%, respectively. The results indicate that the analysis models explain approximately 60% of the total score for business evaluation. Since, the total weight of the X1, X2, and Y evaluation items is 0.6 (= 60%) as shown in Equation (1), the results appear to be commensurately aligned. This indicates that BES is calculated in accordance with the evaluation standards.

Table 4 also shows that the β weights for the debt reliance index, the profitability index, and the scale index are -48.344, 6.400 and 75.151, respectively. These values clearly indicate that debt reliance has a negative influence on BES, while profitability and scale have a positive influence. In other words, the lower a firm's reliance on debt, the higher its BES will be, and, conversely, the more profitable and the larger a firm is, the higher it will be. While this is the expected result, this corroborates the intuitive notion that financially healthy firms with large profits and large firms receive higher scores.

However, the respective *t*-scores indicate that factors 1 and 3 are the statistically significant indices, with factor 3 having a particularly large influence on BES. In other words, the business evaluation before the 2008 revision placed a large weight on company scale and debt reliance. Furthermore, company scale was a particularly important indicator. In contrast, Table 5 shows respective *t*-statistics of -9.531, 3.063, and 15.372, indicating that all signs have been preserved, while slightly reducing the effects of company size and making factor 2 a significant factor. These values indicate that the 2008 revisions have contributed to establishing evaluation standards leading to the goals of a balanced evaluation that is neutral with regard to sales levels. However, the data also indicate a lingering, strong effect of company scale on BES.

Table 4- Regression of business evaluation score (fiscal year 2007) on financial component scores (fiscal year 2006)

Dependent variable	Constant	Debt reliance index score	Profitability index score	Scale index score	Adjusted R^2
Business evaluation score	856.290	-48.344	6.400	75.191	0.604
t-statistic	181.798***	-8.946***	1.356	16.858***	

Notes:

1. The number of observation is 226.
2. ***significant at the 1% level.

[16] Component scores for each index were calculated.

Table 5- Regression of business evaluation score (fiscal year 2008) on financial component scores (fiscal year 2007)

Dependent variable	Constant	Debt reliance index score	Profitability index score	Scale index score	Adjusted R^2
Business evaluation score	865.721	-45.743	13.379	71.904	0.588
t-statistic	188.525***	-9.531***	3.063***	15.372***	

Notes:

1. The number of observation is 238.
2. ***significant at the 1% level.

4.4 Results of the secondary analysis

4.4.1 Data

As described earlier, the secondary analysis is based on information obtained when conducting the questionnaire survey and interviews targeting the 52 member firms in the Fukushima Prefecture Construction Cooperative.[17] The questionnaire used appears in the Appendix.

In order to extract soft information implicitly held within the construction industry in Fukushima Prefecture, the questionnaire survey took the form of a peer-reviewed questionnaire.[18] The questionnaire asked executives at each company to provide answers related to the seven evaluation points not only for their own company, but also for other firms in their same district and in the same class.[19] Of the 52 companies that were the target of analysis, 40 were ranked as A-class companies and 12 as B-class companies. When conducting the surveys, we contacted the president of each company to arrange an appointment, at which we explained the purpose of the survey and conducted an interview. Interviews lasted approximately 1 hour each.

As can be seen from the list of questions, there are a total of 18 items: a) 3 items related to determining companies' technological capability, construction management ability, and construction experience, b) 5 items related to determining companies' organizational, employee management skills, and employees' ability, c) 2 items related to determining companies' skills in planning and business dealings, d) 3 items related to the personality of executives, e) 4 items related to companies' contributions to the local community, and f) 1 item related to companies' overall evaluation. These items were used in an attempt to extract soft information from within the Fukushima Prefecture construction industry related to reputation, rumors, corporate image, and other information that is not generally publicly available, by directly asking company executives—the determiners of these items—and receiving their intuited responses. Analysis was then performed to determine to what extent the obtained information could be used to explain company rankings under the business evaluation, and conversely whether there existed any new or additional soft information that is not reflected by the business evaluation.[20]

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17 Companies participating in the survey were selected from among the Fukushima Construction Industry Association and Fukushima Prefecture Construction Cooperative members, based on locale, business type, and company scale. The survey was conducted via the Fukushima Prefecture Construction Cooperative, allowing us to receive responses from all 52 companies initially approached.

18 As opposed to the usual method of having answers to questionnaires sent by mail, in this case company executives answered the questions on the questionnaire form in person, which should provide much higher data reliability.

19 In Japan, the rural construction companies are ranked by local governments as from A-class to D-class based on their scale and financial characteristics.

20 Note that 325 questionnaires were completed, for a response rate of almost 100%.

4.4.2 Results of simple aggregation

Table 6 shows that there were differences in average scores according to locale, evaluator, and rank. In particular, there was a tendency to over-evaluate one's own company and there was a uniform difference in average score between A-rank and B-rank companies. Of particular note is that there are numerous B-rank companies in the Kitakata and Shirakawa districts, which might explain why average scores are lower in those areas.

4.4.3 Results of principal component analysis2

Table 7 shows that the principal component analysis extracted 3 factors with eigenvalues greater than 1. As can also be seen from the cumulative contribution ratio, those 3 factors explain 76% of all information from the 18 questionnaire items. Furthermore, the first of the 3 factors alone contributes 60%, more than half, of the total information. The factor loadings can be interpreted as follows.

Table 7- Results of principal components analysis 2

Eigenvalues and accounted for variance

Factor	Eigenvalue	Accounted for variance	Cumulative percentage of total variance
1	10.844	60.244	60.244
2	1.968	10.938	71.183
3	0.939	5.221	76.404

Factor loadings

variables	factor 1	factor 2	factor 3
Q1	0.8923**	0.2077	0.1721
Q2	0.8767**	0.2337	0.2336
Q3	0.7892**	0.2872	0.2800
Q4	0.8839**	0.2221	0.2100
Q5	0.8606**	0.2098	0.2967
Q6	0.7850**	0.2417	0.3064
Q7	0.6627	0.2464	0.3450
Q8	0.8571**	0.1237	0.1803
Q9	0.6650	0.3660	0.1522
Q10	0.4641	0.5866	0.2814
Q11	0.2777	0.8706**	0.1892
Q12	0.1767	0.8999**	0.2307
Q13	0.2122	0.7803**	0.3563
Q14	0.4284	0.2922	0.5700
Q15	0.2314	0.3310	0.7448**
Q16	0.3117	0.3066	0.7725**
Q17	0.3471	0.2909	0.7906**
Q18	0.7202**	0.1535	0.2168

** indicates loadings > 0.7.

Factor 1: Q1, Q2, Q3 (technological capability, construction management ability), Q4, Q5, Q6, Q8 (organizational ability), and Q18 (overall evaluation) are highly correlated, suggesting that this is a factor

Table 6- Mean and standard deviation of questionnaire

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18
All data	mean	4.69	4.68	4.71	4.61	4.67	4.35	4.35	4.53	4.32	4.53	5.04	4.91	4.94	4.78	4.70	4.77	4.76	3.39
	S.D.	1.23	1.21	1.26	1.22	1.18	1.24	1.12	1.36	1.20	1.16	1.12	1.17	1.09	1.15	1.06	1.13	1.12	0.84
Kitakata area	mean	3.92	3.88	3.92	3.91	4.17	3.48	3.74	3.96	3.59	3.46	4.17	4.00	4.17	3.65	4.04	4.50	4.67	2.96
	S.D.	0.93	0.74	0.78	0.79	0.78	0.99	1.05	1.04	0.80	0.93	1.34	1.29	1.17	0.98	0.91	1.22	1.17	0.62
Shirakawa area	mean	4.56	4.52	4.56	4.35	4.44	4.21	4.17	4.37	4.17	4.40	5.02	4.87	5.12	4.85	4.62	4.96	4.87	3.37
	S.D.	1.16	1.15	1.21	1.15	1.16	1.23	1.02	1.39	0.94	1.18	0.85	1.10	0.81	0.94	0.77	0.93	0.91	0.69
Soma/Minamisoma area	mean	4.96	5.17	5.12	4.98	4.96	4.75	4.87	4.63	4.81	5.02	5.63	5.63	5.54	5.33	5.35	5.27	5.40	3.50
	S.D.	1.28	1.28	1.54	1.41	1.24	1.33	1.01	1.55	1.37	1.18	0.91	0.89	0.90	1.17	1.06	1.07	1.16	0.87
Kenhoku area	mean	5.09	5.02	5.11	4.98	5.01	4.58	4.47	4.90	4.44	4.86	5.36	5.09	5.00	5.05	4.94	4.89	4.86	3.47
	S.D.	1.16	1.15	1.17	1.08	1.07	1.15	1.16	1.33	1.19	1.01	0.83	0.93	0.90	1.00	1.08	1.13	0.97	0.96
Aiduwakamatsu area	mean	4.48	4.44	4.44	4.43	4.48	4.23	4.22	4.41	4.22	4.33	4.73	4.65	4.69	4.54	4.38	4.43	4.37	3.38
	S.D.	1.21	1.17	1.15	1.21	1.22	1.22	1.12	1.27	1.20	1.11	1.25	1.26	1.22	1.17	0.98	1.10	1.11	0.81
self evaluation	mean	5.17	5.21	5.19	5.14	5.24	4.98	4.55	5.07	4.48	5.52	5.43	5.57	5.60	5.31	5.43	5.45	5.26	3.55
	S.D.	1.27	1.14	1.27	1.30	1.16	1.22	1.21	1.45	1.38	1.11	0.99	1.04	1.01	1.24	1.19	1.19	1.19	0.83
evaluation of other company	mean	4.62	4.61	4.64	4.53	4.59	4.26	4.32	4.46	4.30	4.39	4.99	4.82	4.85	4.71	4.59	4.68	4.69	3.37
	S.D.	1.21	1.20	1.25	1.19	1.16	1.22	1.11	1.33	1.17	1.10	1.13	1.16	1.07	1.12	1.00	1.09	1.09	0.84
companies ranked A	mean	4.93	4.92	4.94	4.83	4.89	4.55	4.52	4.79	4.49	4.71	5.11	4.96	4.99	4.91	4.80	4.88	4.87	3.49
	S.D.	1.17	1.16	1.20	1.13	1.08	1.21	1.10	1.32	1.19	1.08	1.08	1.13	1.05	1.15	1.04	1.06	1.07	0.85
companies ranked B	mean	3.79	3.82	3.85	3.78	3.85	3.61	3.71	3.57	3.71	3.89	4.79	4.72	4.74	4.31	4.32	4.39	4.36	3.01
	S.D.	1.02	0.98	1.11	1.18	1.15	1.07	0.98	1.02	1.04	1.24	1.26	1.31	1.20	1.02	1.05	1.30	1.19	0.66

indicating technological capability, construction management capability, and organizational ability. In this analysis, this factor is taken as a management quality index.

Factor 2: Q11 ,Q12 and Q13 are highly correlated, suggesting that this factor is an indicator of executive personality. In this analysis, this factor is taken as an executive personality index.

Factor 3: Q15,Q16 and Q17 are highly correlated, suggesting that this factor is an indicator of the firm's contribution to the local community. This factor is taken as a contribution to the local community index.

An examination of the first factor shows that technological capability, construction management capability, the company's organizational ability, and other human elements are highly correlated. This fact suggests that there is a strong possibility that this factor has a strong relationship with company scale. From the load of Q18 it is apparent that a company's technological capability, construction management capability, and the company's organizational ability have a strong relationship with the overall management of the firm. Factors 2 and 3, on the other hand, stand separately from the other elements, suggesting that executive personality and corporate contribution to the local community contain information that is unique among the other aspects of company management.

4.4.4 Results of regression analysis 2

Table 8 shows the results of regression analysis using the model below.[21]

$$\text{Total BES } P = \alpha + \beta_1 * \text{managemant quality index score} + \beta_2 * \text{executive personality index score} + \beta_3 * \text{contribution index score}$$

As shown, the model has an extremely high coefficient of determination, namely, 0.829. This indicates that approximately 83% of the total score for the business evaluation can be explained by implicit information held within the Fukushima Prefecture construction industry related to management quality, executive personality, and contributions to the local community. These results indicate that although MLIT intended that weightings on elements beyond the financial data which comprise BES (the Z and W terms) should be 40%, qualitative information related to company quality retained within the Fukushima Prefecture construction industry is so rich as to explain 83% of the total score.

One point worth noting, however, is that in this model the only independent variable that is statistically significant is the management quality index (t-statistic = 14.452).[22] This means that of the within-industry soft information implicitly retained in the Fukushima Prefecture construction industry, only management quality is related to BES, and within-industry information related to executive personality and contribution to the local community are not reflected by BES.

As described above, one of the purposes of the 2008 revisions to the evaluation criteria of the business evaluation was "An evaluation that allows for differentiation according to fulfillment of social responsibility (W)." According to the results of this analysis, however, there is a gap between the manners of fulfillment of social responsibility as measured by the business evaluation and as conceived by within-industry implicit information in the Fukushima Prefecture construction industry. This means that corporate contribution to the local community as evaluated by the construction industry in Fukushima Prefecture is not measured by the business evaluation items related to this topic. This also indicates that the

[21] Similar to analysis 1, we calculated the component scores for each index.

[22] In comparison, the t-statistic for executive personality was approximately 0.678 and that of contribution to the local community –0.342, indicating that these determining factors for the Business evaluation had no statistical significance.

soft information held within the Fukushima Prefecture construction industry contains new information related to contributions to the local community that is unique to the industry. Put another way, the business evaluation set forth by MLIT to evaluate contributions to society are not necessarily the most appropriate for measuring contributions to the local community in rural regions.

Given these circumstances, it is likely that there is value in MLIT's (2008) policy toward local governments for "creating a review manual related to subjective points in order to improve understanding related to the business evaluation and sharing duties related to subjective point evaluation within rural cities, towns, and villages, so that subjective points might be added in a manner allowing for appropriate evaluation." At present, many prefectures, including Fukushima, are following MLIT's manual to introduce evaluations of subjective points, perhaps an inevitable result given the findings of this study. Most subjective point review items implemented by local governments closely follow MLIT's manual however, and further studies are needed to determine the extent to which such guidelines accurately reflect the conditions of rural construction industries, and if they result in appropriate evaluations.

The present analysis included a questionnaire survey and interviews lasting approximately 1 hour with executives from each company, during which we heard comments to the effect that the evaluation standards for the subjective points of comprehensive evaluation were not appropriate for the construction industry in Fukushima Prefecture, and that revisions were needed. On the other hand, there were also comments that frequent revisions to the evaluation standards made it difficult to adhere to them, indicating a feeling that efforts made to adhere to them before modification were wasted. Thus, premature modifications may only introduce further confusion into the rural construction industry. It is important to re-emphasize that, before introducing changes, the situation and industry structure of the rural construction industry must be analyzed in detail, the systems should be carefully designed to ensure they will function appropriately, and all necessary explanations must be made.

Table 8- Regression of business evaluation score (fiscal year 2008) on questionnaires component scores

Dependent variable	Constant	Management quality index score	Executive personality index score	Contribution index score	Adjusted R^2
Business evaluation score	909.424	135.251	8.081	-5.441	0.829
t-statistic	131.219***	14.452***	0.678	-0.342	

Notes:

1.The number of observation is 50.

2. ***significant at the 1% level.

4.5 Results of correlation analysis

The above analysis shows that the regression model information related to management quality held within the Fukushima Prefecture construction industry explains approximately 83% of BES. This result indicates that information obtained via the questionnaire may be richer than that measured by evaluation items Z and W of the business evaluation. Such results further suggest that while this additional information is qualitative data, it has some relevance with the information obtained from financial data during the business evaluation.

To investigate this point, an analysis was performed to look for connections between the three financial data indices obtained during the principal component analysis of the first analysis in this study (the reliance on debt index score, the profitability index score, and the scale index score), the three soft information indices obtained during the second analysis (the management quality index score, the executive personality index score, and the contribution to local community index score), and the business evaluation. Table 9 shows the results of correlation analysis between the indices. There is a high positive correlation between the scale index score (FQS3) from the financial data, the management quality index score (QCS1) from the survey data, and BES. More specifically, the coefficient of correlation between the management quality index score (QCS1) of the survey data and BES is 0.916, a nearly perfect correlation. This means that in the Fukushima Prefecture construction industry, management quality and financial conditions have a particularly high correlation with firm size.

The reliance on debt index score (FQS1) from the financial data has a negative correlation with QCS1 and BES. In other words, in the Fukushima Prefecture construction industry, the higher the reliance that a company has on debt, the lower the industry peer evaluation of that company's management quality, and there is a resulting negative effect on the business evaluation. This suggests the possibility that in the rural construction industry, there is an association between large amounts of debt reliance with managerial instability in the company. Another interesting point is that the profitability index score (FQS2) from the financial data shows no correlation with any of the questionnaire items or with BES. This indicates that, in the Fukushima Prefecture construction industry, there is no relation between profitability and company scale or management quality. One might assume that as a company grows larger, advantages related to scale and scope should help to improve the managerial efficiency of the company. The results of the present study, however, indicate that in the Fukushima Prefecture construction industry, increased scale results in an improved industry peer evaluation of managerial quality, yet there are no accompanying improvements in efficiency, at least from the standpoint of financial profitability. In general, higher managerial quality should lead to improved financial profitability. Nonetheless, the results of analysis here indicate that this is not necessarily the case.

Table 9- Correlation matrix of financial component scores, questionnaires component scores and business evaluation score

	FCS2	FCS3	QCS1	QCS2	QCS3	BES
FCS1	-0.1497	-0.1151	-0.2792	-0.063	0.0011	-0.3182
	(.326)	(.451)	(.063*)	(.681)	(.994)	(.033**)
FCS2		-0.005	0.2191	-0.2089	-0.0828	0.1748
		(.974)	(.148)	(.168)	(.589)	(.251)
FCS3			0.6263	-0.008	-0.0207	0.7315
			(.000***)	(.958)	(.892)	(.000***)
QCS1				-0.1003	-0.2242	0.9167
				(.512)	(.139)	(.000***)
QCS2					0.226	-0.0527
					(.135)	(.731)
QCS3						-0.226
						(.136)

Notes:

1. FCS: financial component score
   QCS: questionnaires component score
   BES: business evaluation score
2. The number of observations is 50.
3. p-statistics in parentheses.
4. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

By contrast, the reliance on debt (FQS1), profitability (FQS2), and firm scale (FQS3) indices scores obtained from the financial data, and the executive personality (QCS2) and contribution to the local community (QCS3) indices scores obtained from the surveys, showed almost no correlation. This suggests that implicitly held information related to the evaluations of executives and social contributions relate to something entirely different from the financial situation, profitability, and the like.[23]

4.6 Additional analysis and results

The correlation analysis above indicates a high correlation between FQS3 from financial data and QCS1 from survey data. This indicates a high probability that some part of the managerial quality information retained within the industry acts as a substitute variable for company scale. To further examine this point, additional analysis of the financial data and questionnaire response data was performed. As in the case of the primary and secondary analyses, this additional analysis began with principal component analysis, followed by regression analysis on the principal component scores and BES with each factor identified by the principal component analysis. These analyses allow for a more detailed understanding of the structure of the comprehensive evaluation methods being introduced in Japan.

Table 10 shows the results of principal component analysis using the financial data and the questionnaire data. The samples used in the analysis are the 52 surveys obtained from the companies. Nine financial data indices and 18 questionnaire item indices from Table 10 are combined into 5 indices with significant information. The following is a description of each of the indices, based on factor readings:

Factor 1: This factor shows a high correlation with Q1, Q2, Q3 (technological capability, construction management ability), Q4, Q5, Q6, Q7, Q8 (organizational ability), Q9 (planning ability), and Q18 (overall evaluation). Focusing on the questionnaire items, this factor serves as an index of the company's managerial quality, but it also has a relatively high correlation with the amount of completed work, a financial data item. Therefore, this factor can be used as a combined indicator of management quality and company scale.

Factor 2: This factor shows a high correlation with Q11, Q12, Q13 (personality of executives), Q15, Q16 (contributions to the local community), and relatively high correlations with Q10, Q14, and Q17. This factor can therefore be interpreted as an index of industry recognition of contributions to the local community.

Factor 3: This factor has a negative correlation with net financial cost to sales ratio and debt to sales ratio, and a positive correlation with equity to fixed assets ratio and equity to total asset ratio, making it an index of financial stability.

Factor 4: This factor has a high correlation with operating profits to sales ratio and gross profits to total assets ratio, making it an index of profitability.

Factor 5: This factor has a high correlation with net worth and operating income, making it an index of company scale.

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[23] It must be kept in mind, however, that the above results are derived from data obtained through the present questionnaire survey and that factors such as questions asked and presentation of the questions can have a significant effect. It goes without saying, therefore, that further analysis, including an investigation of the questions asked, is required.

Table 10- Results of principal components analysis 3

Eigenvalues and accounted for variance

Factor	Eigenvalue	Accounted for variance	Cumulative percentage of total variance
1	12.645	46.83	46.83
2	3.161	11.70	58.54
3	2.650	9.81	68.36
4	2.030	7.51	75.87
5	1.222	4.52	80.40

Factor loadings

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
The amount of completed	0.612*	0.013	-0.078	-0.097	0.531
Net worth	0.415	0.135	0.159	-0.042	0.826**
Operating income	0.023	0.032	0.100	0.470	0.797**
Net financial cost to sales	-0.321	0.062	-0.833**	0.131	-0.019
Debt to sales ratio	0.023	-0.215	-0.785**	-0.044	0.020
Operating profits to sales	0.288	-0.149	-0.160	0.863**	0.202
Gross profits to total assets	-0.407	0.125	0.038	0.734**	-0.013
Equity to fixed assets ratio	0.088	0.065	0.741**	0.144	0.061
Equity to total assets ratio	0.075	-0.005	0.852**	-0.206	0.126
Q1	0.924**	0.236	0.071	0.013	-0.001
Q2	0.890**	0.341	0.124	-0.008	0.073
Q3	0.876**	0.380	0.034	0.005	0.071
Q4	0.927**	0.251	0.090	0.026	0.057
Q5	0.912**	0.228	0.066	0.039	0.110
Q6	0.861**	0.377	0.083	-0.074	0.061
Q7	0.758**	0.360	0.207	-0.026	0.082
Q8	0.927**	0.101	-0.009	-0.042	0.163
Q9	0.780**	0.344	0.147	-0.045	0.209
Q10	0.522	0.651*	0.198	0.085	-0.192
Q11	0.337	0.829**	0.057	0.140	-0.002
Q12	0.141	0.888**	0.110	0.144	-0.019
Q13	0.123	0.924**	-0.005	0.081	0.029
Q14	0.495	0.689*	0.041	-0.177	0.092
Q15	0.248	0.747**	0.130	-0.071	0.021
Q16	0.274	0.716**	-0.132	-0.145	0.106
Q17	0.299	0.655*	0.127	-0.204	0.253
Q18	0.785**	0.171	0.249	-0.082	0.336

** indicates loadings > 0.7.

* indicates loadings > 0.6.

4.6.1 Results of regression analysis 3

Table 11 shows the results of regression analysis according to the models below.[24]

$$\text{Total BES } P = \alpha + \beta_1 * \text{Factor1} + \beta_2 * \text{Factor2} + \beta_3 * \text{Factor3} + \beta_4 * \text{Factor4} + \beta_5 * \text{Factor5}$$

The table shows that Factor 1 (management quality and company scale), Factor 3 (financial stability), and Factor 5 (company scale) had significant effects on BES. In addition, the modified coefficient of determination of this model has a very high explanatory power of approximately 88%. This shows that being a large, financially healthy company, and one that is acknowledged within the industry as having high management quality, leads to higher BES. On the other hand, financial profitability and industry recognition of contributions to the local community had almost no effect on BES. In other words, those companies attaining a high BES were not necessarily financially profitable, nor were they recognized as making substantive contributions to the region by industry peers.

Table 11- Regression of business evaluation score (fiscal year 2008) on total component scores

Dependent variable	Constant	Factor1	Factor2	Factor3	Factor4	Factor5	Adjusted R^2
Business evaluation score	896.58	98.53	-1.33	22.84	-1.40	29.71	0.879
t-statistic	163.70***	17.81***	-0.24	4.12***	-0.25	5.37***	

Notes:

1.The number of observation is 50.

2. ***significant at the 1% level.

The current structure of the business evaluation, in which larger, more financially sound companies with high management quality are awarded higher BES, may on the surface seem like an extremely logical one. After all, generally speaking, larger companies have more employees, are more likely to adhere to compliance rules such as ISO standards, and can obtain more capital—features less likely to be found in smaller companies. A financially sound company, furthermore, will have less risk of failing to complete contracted works due to bankruptcy or other financial crises. One might therefore consider awarding public works projects to such firms under a general competitive bidding scheme as contributing to an increase in social surplus. However, there are few companies of such scale operating in Fukushima Prefecture and other rural regions, and the gap in scale between those companies and smaller ones is extreme. This gap is the result of previous methods of awarding almost all public works jobs in rural regions—negotiated contracts and designated competitive bidding schemes—which cemented roles between general contractors and their subcontractors. In the rural regions of Japan, it became convention that public works contracts would be awarded to a limited number of general contractors through designated competitive bidding, and those companies would complete the construction by hiring small-scale subcontractors. The general contractors would handle overall management, coordination, and operational financing of the construction, and the subcontractors performed the actual work, a peculiar system that developed over many years. This status quo was further cemented by a stable supply of construction jobs during periods of high economic growth.

Given this industry structure, when examining business evaluations as part of the comprehensive

[24] Similar to analysis 1 and analysis 2, we calculated the component scores for each index.

evaluation method used in current bidding systems, it is difficult to view the system as one that is equitable for participation by a large number of companies. As can be seen by the results of our analysis, current business evaluations place a large weight on company scale and financial stability, creating (in rural regions, at least) a system that only a limited number of large general contractors can participate in, an oligopolistic state of affairs to the benefit of the general contractors. Figure 2 shows that the introduction of general competitive bidding resulted in an extreme decrease in bid ratios, which when taken with the decrease in bidding participants from 2010 onwards has brought levels back to those of the era in which designated competitive bidding was the standard practice.

This oligopolistic state of affairs causes several problems with public works construction in Japan's rural regions. The first is that companies will selectively and preferentially bid only on those jobs they are likely to be awarded, while avoiding "unattractive" jobs that are less profitable or will tie up a large number of employees for extended periods. Such jobs are therefore left to those companies with a lower chance of a successful bid for more attractive jobs, and in turn such companies will have only unattractive jobs to bid on, leading to further financial strain. These conditions have been indicated as one reason for the increasing percentage in recent years of rural public works jobs that fail to attract bids.

Unsuccessful public works bids have caused even more serious problems in the Fukushima Prefecture of today. The 2011 Tohoku Earthquake on March 11 and the resulting tsunami caused extensive damage to infrastructure in Fukushima Prefecture, and an intense effort toward recovery construction is underway. Further damage occurred during the summer and autumn of 2011 as a result of heavy rains and typhoons, and there has been still more damage from heavy snowfall that has continued since the beginning of 2012. Many construction projects being ordered now are therefore vital to maintaining the daily lives of prefectural residents. Recent MLIT data show that while only 5% of bids were unsuccessful in fiscal 2010, the rate jumped to 23% in 2011. The rate was a particularly high 40% between September and December 2011, a remarkable increase. Further tightening the focus to November and December, the monthly rates were 55% and 51%, respectively, perhaps due to company avoidance of "unattractive" jobs such as snow removal. Selection of jobs based on profitability is highly logical from the company's point of view. However, all public works jobs related to maintenance and repair work are vital to rural residents for lifestyle maintenance, regardless of the profit potential of such jobs, and thus should be performed in a reliable and rapid manner. Disaster recovery construction in particular is vital for maintaining rural infrastructure, making the current ratio of failed bids a matter of utmost concern, and one that calls for immediate improvements to the bidding system.

5. Conclusions

The following implications can be derived from an interpretation of the results from the primary and secondary analyses of this study. First, the contributed effect of the financial data information on BES is approximately 60%, as designed, but one deviation from the intent of the revisions is that the effect of firm scale is particularly large. Next, of the soft information within the Fukushima Prefecture construction industry, only the information related to management quality corresponds with BES, and the correspondence is quite strong. In contrast, information related to executive personality and contributions to the local community is hardly reflected by BES. Furthermore, within-industry information related to management quality and the company scale index from the financial data has a high correspondence, suggesting that part of the information related to management quality serves as a surrogate variable for scale.

Follow-up analysis indicates that company scale, financial security, and management quality explains 88% of BES. These results indicate that the current system works, from the point of view of securing large, well-run companies to bid on and receive jobs. When the structure of the construction industry in rural areas of Japan is considered, however, there are indications that the current system awards bids only to a limited number of large companies—those companies that have always been positioned as regional general contractors—making the public works market a de facto oligopolistic environment. There is a high probability that this environment is the cause for the rise in the bid ratio and remarkable increase in failed bids described in Section 4.

Following a long period of high economic growth, in recent years most public works jobs in rural areas have focused on repair and maintenance work. Such work is not as highly profitable as construction jobs such as port improvements or subway construction that call for advanced technological approaches, yet they remain important to the public welfare of the region. Should current bidding systems remain in place unchanged, the result will likely be continued trends for avoidance from companies seeking higher profits, and a failure for these jobs to be performed. Furthermore, factors such as seasonal events or natural disasters that can create large shifts in the demand for rural maintenance and repair work require local accumulation of technical knowledge suited to the natural environment of the region.[25] Taking these factors into consideration, refinement of previous systems of designated competitive bidding and negotiated contracts for maintenance and repair work with high levels of regional or public utility, or the implementation of assigned bidding systems, may provide a higher degree of local social welfare than do current general competitive bidding schemes. Further investigations into such possibilities are required, but in any case the results of the present study indicate the importance of closely examining the nature of the structure of the rural construction industry and the public works construction jobs it performs, designing multiple bidding systems best suited to their ends, and putting them into operation. It is necessary to proceed with further theoretical and practical investigations of industry structure and the nature of construction projects with the goal of determining what kinds of systems should be implemented, and in what way.

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Appendix

Questionnaires

Unless otherwise indicated, each item was scored on a seven-point scale (1 = strongly disagree, 7 = strongly agree).

Technological capability, construction management, construction experience

- *The technological capability of Company A is higher than other companies. (Q1)*
- *The quality control of Company A is higher than other companies. (Q2)*
- *The safety control of Company A is higher than other companies. (Q3)*

[25] Examples of construction jobs requiring region-dependent technical knowledge include snow removal operations in hilly and mountainous regions, and coastal improvement work.

Organizational and employee management skills, employees' ability

- *The technical skills of the employees of Company A is higher than other companies. (Q4)*
- *The skills in employee management of Company A is higher than other companies. (Q5)*
- *Company A is putting forth effort into employee training. (Q6)*
- *The operating efficiency of Company A is higher than other companies. (Q7)*
- *Company A has employed more qualified full-time engineers than other companies. (Q8)*

Skills in planning and business deals

- *The work volume of Company A is planned well. (Q9)*
- *Company A has built the high confidential relation with the subcontractors. (Q10)*

Personality of executives

- *The manager of Company A is trustful. (Q11)*
- *The manager of Company A has built the high confidential relations with the managers of other companies. (Q12)*
- *Company A has built the high confidential relation with the local community. (Q13)*

Contribution to the local community

- *Company A has more local employees than other companies. (Q14)*
- *Company A is putting forth effort to do business with local suppliers. (Q15)*
- *Company A contributes to the local community more than other companies. (Q16)*
- *Company A contributes to the local disaster prevention activities. (Q17)*

Company's overall evaluation *(This was scored on a five-point scale.)*

- *5 = very good, 1 = very bad. (Q18)*

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