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Risk management for overseas construction projects

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Contracting overseas construction projects is usually considered a 'high risk business', mostly because of a lack of adequate overseas environmental information and overseas construction experience. Similar construction projects may have totally different risk characteristics in different regions. It is difficult for a newcomer to identify new risks in a new environment. It is more difficult to assess these risks and the subtle impact of relationships among them. On the one hand, ignoring these risks is irresponsible, and unrealistic decisions will result. On the other hand, identifying and assessing all the new risks and their relationships is a very complicated, time-consuming and expensive process. This process is almost impossible for the majority of projects, especially when there are inadequate amounts of information and time. When such a complex scenario is faced, identifying and controlling these vital risk factors in overseas projects becomes extremely important. In this paper, a method of managing various risks for overseas construction projects is developed. How to effectively identify the vital risks in overseas projects is discussed. A useful risk assessment technique is introduced which combines risk probability analysis with risk impact assessment. Vital risk response techniques for overseas projects are also illustrated by a case study from China.

Keywords: overseas contracting, construction risks, risk management, risk assessment

The risks in a construction project may be derived from two sources. The first consists of the environmental impacts, which are called external risks. The second consists of the uncertainties existing in the project itself, which are called internal risks. Overseas construction projects have more uncertainties, especially in terms of external risks, mainly because of the large size of projects and the international issues involved. For example, the fluctuations in the macro-economy and the government policies in a country may have a substantial impact on its international construction projects.

Every construction activity in overseas construction projects, particularly large projects, attracts risk in some respect. Risk management then becomes more complicated and crucial for overseas construction projects. In particular, in a situation such as the precontracting stage, in which there are numerous uncertainties that should be considered but there is not currently enough detailed information available, identifying the vital risks in a new environment is extremely important. An effective risk management method can help in understanding not only what kinds of risks are faced, but also how to manage these risks at the stages of contracting and construction.

A simple, common and systematic approach to risk management, suggested by Berkely and others[1], has four distinct stages: (a) risk classification, (b) risk identification, (c) risk assessment, and (d) risk response. In the first stage, risks should be classified into different groups with certain criteria in order to clarify the relationships between them. The second stage entails the identification of the risks pertaining to risk management. The third stage is to assess and evaluate the effects of these risks. In the final stage, appropriate risk response policies should be developed to reduce and control the risks.

In this paper, a comprehensive risk management method, based on the Berkely approach, is introduced for overseas construction projects. Firstly, a hierarchical structure for classifying various sources of risk in overseas projects is presented. Secondly, the identification of risk factors in overseas projects is investigated. Thirdly, an effective risk assessment technique is introduced which combines risk probability analysis with risk impact assessment. Finally, the risk response techniques for overseas projects are also examined, and some strategies for risk allocation among project partners are suggested.

Risk classification

It is necessary to set up a systematic framework for classifying the risks in overseas construction projects,

because risk factors in overseas projects cover such huge areas, and the linkages between them are so complicated. There are numerous ways that can be used to classify the risks for construction projects, for example in accordance with their occurrences in different construction stages, or in accordance with the nature of the risks[2,3]. In this paper, risks are classified in terms of their initial sources: the external and internal aspects of an overseas construction project. The external risks are those changeable factors that relate to the national/regional market or the local construction industry which have significant impacts on the project. The internal risks are those uncertainties inherited by the companies involved or determined by the project's own nature.

At national or regional level, the risk factors can be classified into three categories: the political situation, the economic and financial situation, and the social environment. The risk factors at the construction industry level can be divided into four sub levels: construction market fluctuations, changes in construction law and regulations, differences in construction standards and codes, and differences in construction contract systems. The risk factors at the company level can be grouped into five main categories: risks generated by the employer/owner, risks relating to the architect, risks caused by direct labour and subcontractors, risks caused by materials and equipment suppliers, and risks arising from internal activities of the company. The risks at the project level are those directly associated with cost overrun, schedule delay and physical work defects. The detailed structure of the classification is shown in *Figure 1*.

Risk identification

Although risk factors in overseas construction are different from project to project, there are some factors that affect overseas projects in general. *Figure 1* lists the common factors in line with the above four risk classification groups.

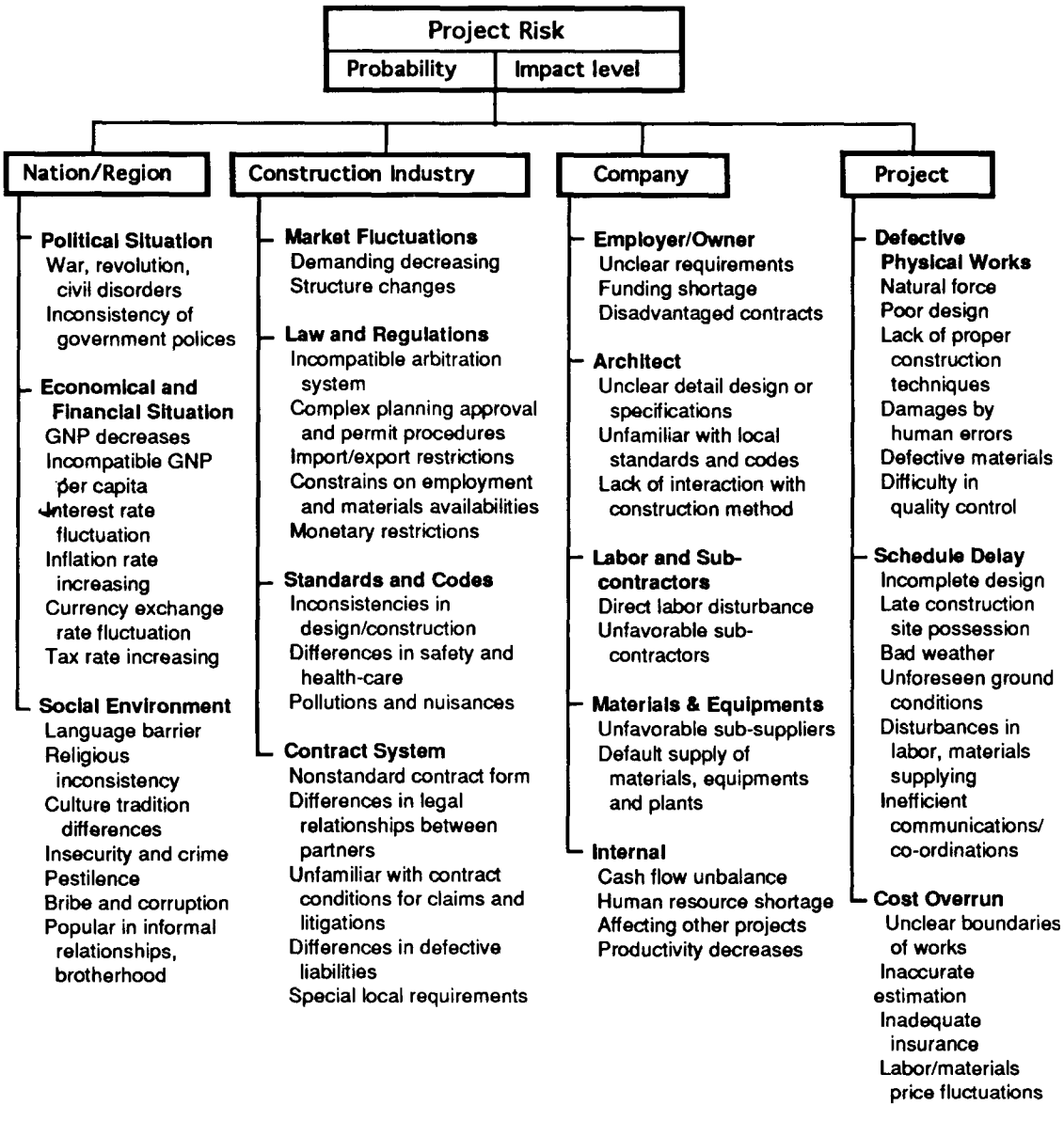

Figure 1 Risk identification hierarchy for overseas construction projects

The major risk factors for overseas construction projects at the national or regional level are those related to economic, political and social change. The most distressing political risks are war, revolution, civil disorder, and inconsistency of government policies. The economic and financial risks may arise from a local economy crisis (such as a sharply decreasing GNP), significant under-development (such as an incompatibly low GNP *per capita*), interest rate fluctuations, rising inflation, foreign currency exchange rate fluctuations, and rising tax rates. Social environment problems are most likely to be caused by language barriers, religous differences, cultural differences, crime and lack of security, disease, bribary and corruption, and informal relationships and brotherhood.

It is particularly important to consider the risks in overseas projects from the national/regional macroeconomic and political standpoints, simply because these risks are unfamiliar compared with those of the domestic environment, and they are significant, particularly for large projects. For example, project funding and cost escalation for large overseas projects are commonly linked with the macroeconomic factors of the host country, such as fluctuations in inflation, interest and currency exchange rates[4]. The magnitudes of these macrolevel risks are increasing in overseas construction as the projects increase in size. Furthermore, these risk factors are beyond the control of contractors. If they occur, all the businesses in the location are affected. The risk factors cannot usually be reduced by a single company's performance, but they can be managed by reasonably allocating them among partners through construction contracts and performance targets. They are comparatively predictable and measurable if adequate statistics are available.

The risk factors at the construction industry level are generated mainly by the activities or events that are unique to the construction industry in an overseas country or region, such as construction market fluctuations, changes in construction law and regulation, and differences in construction standards, codes and contract systems. Construction market fluctuation is caused by unexpected slumps of the market workload, or changes in the structure of the workload. The major common problems relating to overseas law and regulations are a lack of an arbitration system, complex planning approval and permit procedures, import/export restrictions, constraints on employment and materials supply, and monetary restrictions. Unfamiliar overseas design and construction standards and codes, safety and healthcare, and pollution and nuisance protection may also create risks. Non-international-standard contract forms, different interpretations of contract terms, lack of familiarity with contract conditions for claims and litigation, differences in defective liabilities, and special local requirements are common problems in overseas contracting.

The risks relating to the construction industry should also be emphasized. Incompatible construction practices in different construction industries are becoming a more significant factor as global construction markets, associated with the new global economy, become more integrated and fluid. For example, problems in terms of compatible regulations and standards for architectural design and construction are more apparent in European Union markets as the markets seek new levels of harmonization. Unfamiliar practices in a new construction industry may cause crucial problems in overseas construction. Risk factors at the construction industry level affect the majority of construction businesses in the industry, as do the risk factors at national/regional level similarly. It is very difficult to control them, but they can be predicted if enough information is available.

At the company level, risks mainly arise as a result of the external activities between companies and the internal activities within a company. The external activities can be classified into four major types of relationship, with the employer/owner, the architect, direct labour and subcontractors, and materials and equipment suppliers. The problems caused by the employer/owner relate to often unclear requirements, funding shortages, and contracts disadvantageous to contractors. The common problems caused by architects are unclear detail design or specifications, lack of unfamiliarity with local standards and codes, and lack of knowledge of local construction methods. The risks arising from direct labour and subcontractors often include problems in the direct employment of local labour, and unfavourable local subcontractors who are nominated by the owner. Similar problems may occur in relation to the local materials and equipment suppliers. Internal risks may result from unbalanced cashflows, especially in foreign currencies, a shortage of human resources to work overseas, and the removal of equipment or plants overseas affecting other projects or reducing company productivity.

The risks at the construction company level are also becoming more volatile for overseas projects, as international competition between construction companies becomes more intense. The relationships between project partners become more complex as construction projects become larger. To cope with increasingly competitive markers, many contractors have taken on overseas projects that have exacting conditions or that involve multiple dealings. Nowadays, large international contractors have to cover a much wider range of businesses, and they have to engage in more financial and other dealings, rather than just construction. Thus the financial performances of the project partners are becoming significant. All of these features of current construction contracts increase the risk level and affect the projects significantly. For example, any company financial problems can often cause major difficulties for a company's overseas construction projects. However, these risk factors can be under the control of a company's management, but be less predictable and comparable.

The project level risks are derived from the project's characteristics. The risks may cause defective work, schedule delays or cost overruns. The risk factors at the project level are similar for domestic and overseas projects. The risk factors that may cause defective work include natural forces, poor detail design, lack of proper construction techniques, defective materials, and inadequate quality control. The factors that cause schedule delays include incomplete design, late construction site possession, bad weather, unforeseen ground conditions, fluctuations in labour and materials supply, and inefficient communications and coordination with the locals. The risks of cost overrun may be naturally generated by uncertain boundaries of work packages, inaccurate estimation, inadequate insurance, and local labour and materials price fluctuations. These risk factors can be controlled directly by the project management, but it is more difficult to assess them in advance, because the detail risks are unique to the project, and have usually never been experienced in the same way before.

It is dangerous to focus only on the risk factors at project level for overseas projects. This is the major difference between an overseas project and a domestic project in terms of risk. In risk classification and identification for an overseas project, a global view is required to cover the risks from all levels.

Risk assessment

Several criteria are used in judging whether the level of risk is high or low, such as the probability of an undesirable occurrence, the degree of seriousness, and the subsequent impact if it does occur. When people talk about risk, one or more such risk criteria may be involved. Therefore a multicriteria structure for risk identification is needed. In this paper, Williams' suggestion[5] is adopted, i.e. the risk concept is broken down into two main criteria: (a) the probability, which is the possibility of an undesirable occurrence, such as a cost overrun, and (b) the impact, which is the degree of seriousness and the scale of the impact on other activities if the undesirable thing occurs. Using a mathematical description, a risk can be described as follows:

$$R = P \times I$$

where R is the degree of risk, within $[0,1]$, P is the probability of the risk occurring, within $[0,1]$, I is the degree of impact of the risk, which is defined as being within $[0,1]$, (the more serious the impact is, the greater the figure).

From the above risk equation, it can be seen that the degree of risk is near 0 if a risk factor has either little impact or little probability of occurrence. In contrast, if a risk factor has a high impact and a high probability of occurrence, its degree of risk is very high, near 1. This definition of risk would be more realistic for construction practice. In overseas construction projects, the risk factors with a high probability and a high impact are not difficult to identify, but, too often, many risk factors with a medium probability or a medium impact have been neglected in the construction process. They may present a considerable degree of risk and be significant to a project. Therefore, in order to assess a risk factor, it is necessary to not only assess its probability, but its level of impact as well.

There are two main ways in which risk probability can be assessed: subjective judgement, and objective analysis. Subjective judgement means directly estimating the probability of a risk factor. This is easy and practical for construction projects, but it needs experience and scrutiny. Some risks in overseas construction projects which appear quite often and for which there are many comparable experiences can be assigned a probability by direct subjective judgement.

Objective analysis is another approach used very widely for assessing the probability of a risk factor. However, some historical data is required. Sometimes, this makes the application of the method impractical in construction practice, especially for overseas projects, because overseas projects are usually unfamiliar, and it is difficult to find comparable information.

There are many methods that can be used for assessing risk impact. However, in this paper, the use of the analytic hierarchy process (AHP) method to assess the impact of risk factors is suggested. The AHP method, developed by Saaty[6], deals with the relative priority or importance of each factor by pairwise comparison of all factors with respect to certain criteria. A hierarchical structure of these factors is formed by grouping them into different levels. The application of the hierarchical structure allows the risk factors to be broken down into details. This has been found to be very effective in construction practice[7], because risk factors are numerous, particularly in large projects, and the ability of humans to assess many factors at the same time is very limited. Therefore, it is necessary to break down the numerous risk factors into small groups, so that people can easily assess these small group risk factors step by step, and then combine them to obtain the whole risk assessment.

Once a hierarchical structure has been constructed, the impacts of the factors can be compared. Firstly, the factors in each group are pairwise compared with respect to their upper level factor. The pairwise comparison process is carried out by asking which is the more important of each two factors, and then allocating a comparison ratio to them[8]. After all the factors in a group have been pairwise compared, the importance weight $[0,1]$ of every factor can be derived[9]. The same process can be used for the comparison of factors in other groups at other levels, usually from the top level of a hierarchical structure to the lowest level. The final importance weight of every factor is determined by multiplying the weights of the factors at the upper levels down to the factors at the lower levels along with their vertical relationships.

After assessing both the probability and the impact of the risk factors, the degrees of risk of the factors can be obtained by multiplying their probabilities and impacts correspondingly. These degrees of risk fall within $[0,1]$, and the larger the value, the more risky the factor. This process finally results in a ranking of the degrees of risk for all the risk factors. The ranking of the risk factors provides a basis for considering the priority of the response to the various risks in a construction project.

Risk response

It can be seen that the above stages of risk management do not actually remove the risks in an overseas construction project. They merely provide an organised process for recognising the risks in the project. Thus the final stage of risk management, risk response, appears to be the most important stage in risk management. Risks can be responded to through three broad channels: by contract, by insurance, and by retention management. The first two are methods of allocating the risks to external parties, and the last one reduces or controls the risks by internal management.

Allocating risks through contracts is a very common method in construction practice. For overseas projects, some risks can be allocated to the local employer/owner or the local subcontractors. This requires skilful precontracting negotiations and experienced postcontracting administration. The common risks in an overseas project that can be allocated to other parties through contracts are the following:

To employer/owner:

- interest rate fluctuation (or allocate this to banker);
- inflation;

- foreign currency exchange rate fluctuation;
- tax rate increase;
- funding/payment shortage;
- defects from nominated local subcontractors or materials and equipment suppliers;
- late construction site possession;
- bad weather;
- unforeseen ground conditions;
- fluctuations in labour or materials supply (or allocate this to subcontractors/subsuppliers);
- inefficient communications/coordination.

To architect:

- unclear detail design or specification;
- incompatibility with local standards and codes;
- incomplete design;
- lack of interaction with local construction methods.

To local subcontractors/subsuppliers:

- safety and health-care standards problems;
- pollution and nuisances;
- poor detail design;
- defaults in physical works;
- defective materials.

Insurance can also reduce the risks in overseas construction projects. Nowadays, many countries, including almost all the OECD countries, have set up national investment insurance schemes[10]. They offer insurance for new investments and other businesses in foreign countries against noncommercial risks, but to different extents in different countries. However, overseas insurance is never cheap. Identifying which kinds of risk require insurance rather than contract allocation or retention needs careful consideration. The following risks in overseas construction projects can be insured, either in whole or in part[11]:

- losses due to war and revolution, or disorder damage to tangible property;
- confiscation of tangible property or bank accounts maintained in host countries;
- inconsistency of government policies;
- bribary and corruption;
- economic crisis;
- inflation;
- foreign currency exchange rate fluctuation;
- natural forces and bad weather;
- performance bond risks;
- design risks;
- liability for payment for the completed works;
- construction delay due to other parties' defaults;
- pollution, penalties/liquidated damages;
- crime and lack of security;
- disease;
- resources supply risks;
- testing and commissioning risks.

Whatever risks remain after the above two risk response strategies have been used have to be borne by the contractor. It is important to understand that the value of the remaining risks should be within the capacity of the contractor to absorb[12]. Otherwise, they may be very dangerous to the project contractor. After all, the kinds of risk factor and the degree to which these risks can be transferred or insured largely differ from place to place and from project to project.

Case study of risk management

A case study that uses the above risk management method is described below. The project is the development of a residential–commercial complex building in a northern city in China. The development is a joint venture based on a 50%/50% share between a foreign company and a local government based company. The development includes land acquisition, the removal and compensation of old residents, building construction, and a renting operation. These will all be directly managed by various subsidiaries of the foreign company. A piece of land of 8900 m^2 on the fringes of the city has been acquired on the basis of a leasehold of 50 years. Twenty-three households and a warehouse must be removed from the land. A new complex building will be built which comprises four-storey shops of 8054 m^2 and twelve-storey residential apartments of 13 300 m^2. The whole complex will be rented out for 50 years, and it will be given away to the local government afterwards. The target tenants of the building are mainly foreign businessmen and their families.

Before signing the joint venture contract, the foreign company carried out a survey to identify the potential market and the development risks for the project. The survey covered the project members, local government officials, consulting firms, and the residents originally living at the location. Twenty-one risk factors were identified by the survey:

- high inflation;
- bureaucracy;
- low social security at the location;
- corruption;
- lack of nearby education facility;
- lack of nearby transportation facility;
- tax rate changes;
- exchange rate fluctuations;
- lack of legal system;
- lack of nearby communications facility;
- pollution problem;
- language barrier;
- inconsistent policies;
- lack of free market mechanism;
- lack of nearby hospital facility;
- lack of local government support;
- different culture and customs;
- unstable government;
- lack of commodities;
- slow down in economic development;
- war/social disorder.

Secondly, these risk factors were assessed by a professional group selected from local professionals and the foreign company. Thirty-six professionals were asked to select the ten most important factors from the 21 factors. After agreement on the ten most important factors had been reached (see *Figure 2*), estimates of the probability of occurrence of each risk and the corresponding impact level for each factor of the ten were requested for detailed assessment. The probability of occurrence for each factor was assessed via the direct judgement of the professionals after careful consideration. All of the factors had a high probability of

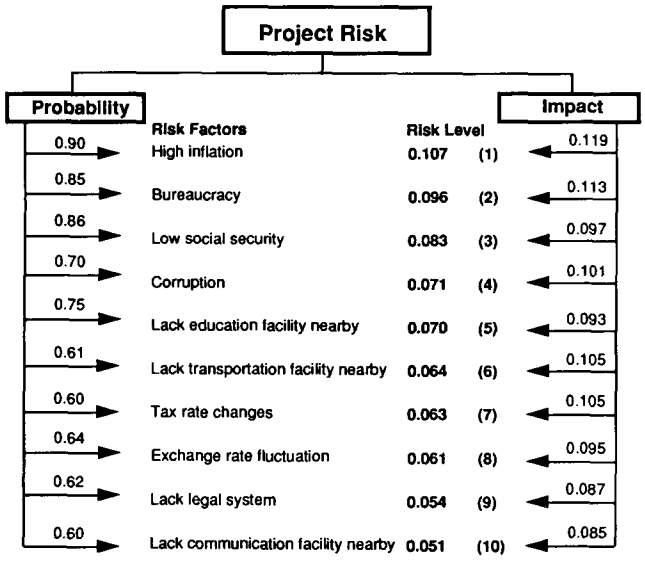

Figure 2 Risk assessment for overseas development project

impacting on the project, as shown in *Figure 2*. The risk factors were then compared in terms of their relative weights of impact on the project. Because only ten risk factors had been selected, the structure for the risk factor comparisons was simplified, as all the risk factors were compared at the same level. The impact weight assessment was carried out by comparing the factors one by one, and then creating comparison ratios for the ten factors (see *Figure 2*).

After obtaining the probability and the impact weight for each risk factor, the combined risk level of each factor was easily calculated by multiplying its probability by its impact weight, as shown in *Figure 2*. The group then proposed various risk response approaches to help the foreign company to deal with the various risks. The ten factors and the risk response strategies are described below.

- *High inflation:* This, having high probability and high impact, was ranked first. The urban inflation rate has recently been as high as 25–30%/year in China, and the project development was estimated to last at least three years because of its complexity and the difficulty of removing existing residents. High inflation will definitely affect the construction costs and other costs significantly, and it will be impossible to avoid. The company decided to carry out two actions. One was to contract all local construction firms with lump-sum contracts to reduce the inflation impact on construction costs. The other was for all rental contracts with tenants to be on an annual basis, to share the inflation risk for the operation and the maintenance costs with the tenants.
- *Bureaucracy:* The project partner is a local government based company whose habits of slow operation are deeply ingrained. Many of the operational decisions of the company have to be approved by the relevant government officials, which may cause the development of the project to be very complicated and inefficient. To avoid this risk, the company has adopted the strategies of maintaining close relationships with the local government officials and communicating with them as much as possible, and at the same time recording everything in black and white.
- *Low social security at the location:* This was ranked third, mainly because the building is located on the fringes of the city, which is less secure, and subject to criminal activity. To reduce the risk, the building will be installed with electric locks, security doors and door-phone systems. Closed-circuit television cameras will also be installed at various strategic locations.
- *Corruption:* This has a relatively low probability of occurrence but a high impact weight, and so it was ranked fourth. Because of the complications related to the local personnel involved in the joint venture, and the recent popularity of 'looking for money' in China, the risks of corruption have been noted by the company in advance. The foreign company has decided to appoint a local firm as a consultant, and let the locals deal with this sensitive problem.
- *Lack of nearby education and transportation facilities:* Because of the relatively remote location, the lack of nearby education and transportation facilities will impact on the rental potential of the building, and these problems were ranked fifth and sixth, respectively. These are risks that the company cannot escape, and what the company can do is to provide a free shuttle bus between the location and the inner city.
- *Tax rate changes:* The joint venture enjoys a tax exemption policy of two years at a zero rate, and then three years at half rate, starting at the time of making profits. However, China is now under pressure of blame in terms of unfair competition policies, and so there is always the possibility that the favorable tax policy for foreign companies will be changed in the future. To reduce this impact, the company has adopted a slow depreciation and quick profit return policy for the investment.
- *Exchange rate:* The potential tenants include locals who will pay the rent in RMBs, the China dollar. The outlook for the exchange rate of the RMB with foreign currencies is not very optimistic in the long term, although the exchange rate with US dollars has been quite stable recently. To reduce this risk, the company is thinking of buying and exporting some Chinese products that are in demand instead of converting the profits directly to foreign currencies.
- *Lack of legal system:* So far, China has no real estate development and management laws. At the same time, however, it has too many regulations and rules from various government departments. The lack of a legal system could not only cause deadlocked disputes in the construction process of the building, but also risk the rental operation in the long term. The company is aware of this factor, and will employ a strategy more of 'shaking hands' than searching lines in contracts.
- *Lack of nearby communications facility:* This risk was ranked tenth. The level of development of telecommunications services, such as telephone and fax lines, by the local government is far behind the market demand. It is not unusual to wait more than one year for a telephone line in China, especially on the fringes of an urban area. The company has used the early booking method, and is prepared to pay an extra fee for prompt installation.

The risks of war/social disorder and slow development of the economy were surprisingly ranked bottom in the first round survey, which shows confidence in the fast development of the Chinese economy, even in the post Deng Xiaoping period. The risk of unstable government was also ranked very low. The other less risky factors that were not in the first ten were social problems, which the foreign company was aware of. The company has employed several members of staff who know the locals to avoid social misunderstandings.

Conclusions

As we have seen, the risks in overseas construction projects can be enormous. In order to manage them effectively, a comprehensive method for managing risks during the construction process, particularly in the precontracting and postcontracting stages, should be applied. The method described in this paper has provided contractors with a supportive framework for the risk management of overseas projects. The method supports a systematic thinking process that classifies risks, identifies risks, assesses risks, and allocates risks. In relation to the risk identification and classification processes for overseas projects, the need for a global view has been emphasized, not only in terms of the project itself, but also in terms of the macrolevels of the political and economic situations in the region. The vital risk factors in overseas projects should be carefully examined, and not only the probability of occurrence of each risk, but also its impact level, should be considered. The risk response methods used in overseas projects should vary from project to project, and should be very flexible in terms of their operation.

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