Insurance and construction project risks: a review and research agenda

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Abstract:

There is a growing body of interests in construction insurance, supporting interactions between the construction industry and the insurance industry. However, it is not always clear why construction insurance exists and how it operates from the perspective of the construction industry. This paper argues that to provide a convincing explanation on this interaction, one needs to improve the theoretical and analytic frameworks in four key areas: the nature of construction risks, risk transfer and insurance mechanism, insurable risks, and perspectives on risks from concerned parties. They explain how insurance can be used as a risk transfer tool in the construction industry and examine the interaction between risk management and insurance. The existing literature on construction insurance is reviewed in the light of this analysis to identify key gaps in knowledge and help to focus further the research priorities. A better understanding of construction insurance can contribute to successful risk management performance on projects.

Keywords: construction insurance, construction risks, alternative risk transfer solutions, insurance purchase, risk management, procurement methods, construction contracts

Introduction

Construction insurance is a practice of exchanging a contingent claim for a fixed payment to protect the interests of parties involved in a construction project. Construction insurance is a major method of managing risks in the construction industry. Its primary function is to transfer certain risks from clients, contractors, subcontractors and other parties involved in the construction project to insurers to provide contingent funding in time of difficulty. Construction insurance plays an increasingly important role in

guaranteeing the success of projects, with insurers sharing losses resulting from natural disasters and other contingencies. However, insurance sometimes doesn't receive the attention it deserves because practitioners do not have a clear understanding of risk allocation and the strategy of risk management through insurance.

Nature of Construction Risks

The sensitivity of construction projects to an extremely large matrix of risks is due to the inherent characteristics of construction projects (Bunni, 2003). A construction project is a unique product. It has:

(1) Internal Characteristics

- many stakeholders
- involves major capital investment
- great diversity of end uses
- many work sites and use of large, mobile equipment
- works not removable
- often high-value and long lasting

(2) External Environment

- natural hazards (flood, lighting, earthquake, storm)
- site conditions
- surrounding property/structure
- theft, war, unproductive labour and strikes

(3) Management Aspects

- contractual obligations
- cost control
- Time control of a lengthy period spanning planning, investigation, design, construction and completion of construction project
- quality control
- Contract management involves temporary project teams down together to complete a project

- environmental protection
- health and safety management
- political risk management

A project can have many stakeholders e.g. clients, suppliers, manufacturers, contractors and subcontractors. The unique characteristics of different projects leads to a high probability of risks and claims, which may happen during or after the construction process. Therefore construction projects require special treatment.

Risk Transfer and Insurance Mechanism

Uncertainty surrounds many issues in construction projects. Managing uncertainty involves managing risks. Risk management systems are designed to deal with risk. The different perspectives of risk lead to distinct definitions of risk management. Normally, risk management focuses on managing the adverse consequences of risk. As Flanagan and Norman (1993) stated: “risk management is a discipline for living with the possibility that future events may cause adverse effects.” Risk management can be described as a structured process in which decisions are made to reduce the likelihood and/or impact of risk occurrence (Broome, 2002, Bunni, 2003, Treceno et al., 2003).

Risk management involves managing risks with both negative and positive outcomes. Risk management is a continuous process where the sources of uncertainties are systematically identified, their impact assessed and qualified, and their effect and likelihood managed to produce an acceptable balance between the risks and opportunities (Dawson, 1997, Williams et al., 1998). A famous Chinese ancient philosopher Laozi said: “huo xi fu suo yi, fu xi huo suo yi”. It means that if risks cannot be dealt with properly, opportunities can be transferred to loss; while if risks can be treated correctly, threats can be turned into opportunities.

Risk management is about understanding a project and making a better decision regarding the management of that project tomorrow (Smith, 1999). Dawson (1997)

summarized that although there was inconsistency between the definitions, there were similarities:

- It is a formal process.
- It employs systematic and scientific methods.
- It aims to identify risks in an operation or business.
- It evaluates the importance or impact of those risks on the operation or business.
- It provides mechanisms to control the individual risk to provide an acceptable level of overall exposure.
- It is not a one-off event.

The aim of risk identification is to identify all significant sources, events and causes of risk within a project. Risk assessment is used to define and assess the technical aspects of each risk. Risk analysis is the process during which the various aspects of each risk, together with the risk dependency chains, are used to determine the effects of the risks on the project and the tasks within the project (Tah and Carr, 2001). Effective risk control reduces exposure to risk and mitigates loss. Tthe attitudes and responses to risk are:

(1) Risk retention or absorption

(2) Risk reduction or mitigation

- Education and training to alert the staff to potential risks
- Physical protection to reduce the likelihood of loss
- Systems to ensure consistency and to make people ask the “what if” questions

(3) Risk transfer

- Insuring against the impact of an event
- Sub-contracting to another party
- Modifying the contract conditions to ensure the risk is modified

(4) Risk avoidance

The principal guideline in determining whether a risk should be transferred is whether the receiving party has both the competence to fairly assess the risk and the expertise necessary to control or minimize it (Kangari, 1995). A contract is traditionally used as a risk sharing and allocation tool. As a project progresses, the nature and extent of risks

may change, new risks may emerge and existing risks may change in importance or be re-allocated, and any such changes may also aggravate or ease some other risks (Rahman and Kumaraswamy, 2002). Proper and exhaustive allocation of risks cannot be achieved through contract conditions alone (Rahman and Kumaraswamy, 2002).

Risk management solutions implemented can be expressed in terms of the basic strategies of risk management behavior, the dimensions of which are the level of risk management and management's strategic consciousness (Suominen, 1995) (Figure 1). For example, a high level of risk management can be achieved through the application of an insurance-weighted transfer strategy or a deliberate control strategy. However, the application of a risk-aware strategy or a shift strategy implies greater risk taking and a lower level of risk management for companies.

When the level of risk management and management's strategic consciousness are both low, a shift strategy is used. It often happens where there is no tradition of risk management and insurance. It is only when the risk management level is high and the management's strategic consciousness is low, that insurance is perceived to be the primary tool for risk control. Insurance is not always the best option for risk management. When management's strategic consciousness increases to a certain extent, there are alternative ways to deal with risks.

		Strategy Awareness: High	Strategy Awareness: Low
The Level of Risk Management	High	**Deliberate control strategy** • Insurance is considered as the last resort of risk management • Emphasis on loss prevention • Wide application of risk management operations, and the linking of insurance solutions to the company's risk management policy • Versatile application of a captive programme • Conscious utilization of risk-bearing capacity, big and small retention in use.	**Insurance-weighted transfer strategy** • Insurance as the primary tool for risk control • High insurance cover, low retention levels • Low risks at own expense • High insurance premiums • No knowledge of the opportunities offered by risk-bearing capacity
	Low	**Risk-aware strategy** • Insurance is not the primary form of risk management behaviour • Searching for the limits of risk-bearing capacity • No insurance available, risk entirely one's own liability • Courageous use of high retention levels, consequences known • Insurance against risk too expensive due to high premium • Retaining some classes of risks such as transportation risk, product liability, consequential loss and loss of credit	**Shift strategy** • Relying on the previous mode of operation • No knowledge of the existence of risks and their consequences • No knowledge of the options in risk management • Negative attitude toward insurances and external services • Seeing insurance as a secondary issue • Giving up insurances at random • The attitude "we've made do without insurances before"

Figure 1 The Basic Strategies for Risk Management Behaviour

Source: Developed from Suominen (1995)

Insurable Risks

Insurable risk means a risk, which can be covered by insurance. For a risk to be acceptable by an insurer, it has to be a "pure risk" which means it has the downside of the effect only (opportunity for loss only), speculative risks are not covered by traditional insurance. Moreover, it has to be sudden and accidental, with statistics available for insurers to simulate past events and generate a creditable premium.

Contractors' All Risks (CAR) insurance can cover physical damage to materials to be used for the project - whether in transit, in storage or forming part of contract works. Even if a risk is insurable, many factors related to the insurance policy need to be considered including: adequate limit; cost/premium; insurance period; negotiation and flexibility of an insurance policy; limitations and exclusions of the insurance policy; sharing risks with insurers (deductible); ability and honor of insurer to indemnify the damage to the insured (security); insurance gaps and overlaps.

The deducible is usually one of the most sensible things in placing insurance. The reasons for deductibles are twofold: firstly to eliminate small claims, where administration costs often can exceed the claim itself; and secondly, to ensure that the insured will comply with their obligation to avoid claims by taking all reasonable precautions to prevent loss or damage (Howard, 1997). Thus, it encourages a better risk management especially in risk reduction.

Wang et al. (2004) regarded insurance as an effective mitigation measure to the risks whether they are at country, market or project level. For example, political insurance was recommended to mitigate risks of changes in law, justice enforcement, expropriation and political instability; design liability insurance for improper design; third party insurance to compensate the general public and staff. However, not all risks can be transferred to insurance. Traditionally, risk assessment checklists have offered a framework for identification of insurable risks (Williams et al., 1998). Both insurance survey and risk analysis questionnaires can help identify insurable risks.

Definition of Construction Insurance

From the legal viewpoint, insurance allocates the risks to which the project is exposed, between the parties. From an insurance aspect, risk forms the basis of insurability and premium calculation (Bunni, 2003). Dickson (1983) highlighted insurance as a risk transfer mechanism that the insured transfer from a state of uncertainty to a state of

certainty at the certain cost of the insurance premium. It is a cost-smoothing mechanism, in which contractors exchange a regular known annual premium for an unknown potential loss.

Insurable risks are defined by FIDIC (1986) and CII (1993) together as follows:

- An insurable risk must be measurable in quantitative terms and in such a way that the theories of probability and the law of inertia of large numbers may be used.
- A large number of homogeneous and relatively independent exposure units.
- Potential losses that are accidental and unintentional.
- Losses that are determinable and measurable.
- Reliable estimates of claim frequency and severity are available.
- The risk charge or premium is economically feasible.
- The insured must have an insurable interest in the object of the insurance contract.

Therefore, whether insurance can be used as a solution depends on:

- The insurability of the risk.
- The adequate and tailored policy.
- The comparison of the insurance premium and the potential loss of risks.
- The trust and confidence of insurers about their solvency and claim service.
- No other alternative risk transfer solutions available.

A typical construction project will consider insurance on:

- Material Damage.
- Third Party Liability.
- Materials in Transit
- Damage to Constructional Plant
- Non-negligent Indemnity
- Consequential Loss.

Insurance covers not usually included but obtainable:

- Employer’s Liability/Workmen’s Compensation
- Motor
- Professional Indemnity (for Architects, consulting engineers etc.)
- Inherent Defects

- Contract Performance Guarantee Bond.

Perspectives on Risks from Clients, Contractors and Insurers

Risk management is a process in which decisions are made to either accept a known risk and/or to eliminate or mitigate it (Treceno et al., 2003). However, the question is which party should carry construction risks and at what cost? There are many parties involved in the construction industry, including clients, contractors, subcontractors, insurers, and suppliers. Chapman and Ward (1997) stressed that different parties involved in a project frequently have different perspectives on the risks according to their own background and benefits. Client bodies might be principally concerned with the risk of the project not being finished on time and exceeding the budget which has been allocated; contractors may be focused on making a profit out of their work on the project; and the workers might well be concerned about the health and safety of their day-to-day working environment and the risk of having accidents and suffering ill health (Anderson, 2000). In addition, some risks are peculiar to one party and some shared with other parties (Baartz and Longley, 2003). Therefore, there are so many conflicts and claims in the whole project life cycle. The different parties have different knowledge and perceptions of risks, which interact with their various objectives and priorities. The risk is best placed with that party involved in the management of a project who is best able to manage the factor which gives rise to it (Flanagan and Norman, 1993). For example, a client deals with political risks; contractors can control safety risks; design consultants are responsible for design defects. Construction insurance can cover the interest of clients, financiers, contractors, subcontractors, architects, engineers and suppliers.

Clients

The clients of the industry ultimately pay the bill and it is important to understand their needs and expectations. From clients' perspective, the risk management process should start from briefing of project to the handover to users. Clients are the first party to

conduct the risk management process and involve contractors during the construction stage or at an earlier stage according to the procurement method. For example, construction and design would involve contractors from the design stage. Clients want to achieve their desired objectives, i.e. cost, time and quality.

Edwards (1995) stated that a promoter (financier or client) is concerned that a reasonable rate of return is obtained for the risks undertaken and how likely changes in estimated costs, benefits and timing will affect that rate of return. A traditional view is that the more risk is transferred away from the client, the safer and more secure his budget will be (Boothroyd and Emmett, 1996). However, this should be balanced with the overall cost of risk transfer.

Main risks faced by clients can be (Palmer et al., 1996, Baartz and Longley, 2003): failure to fund; failure to make progress payments; extra government administration cost; land acquisition risk; client-furnished materials not available; major changes in requirements; interference among parties; and project delay. These risk factors can lead to fears that increasing cost, faulty projects and frequent repairs, abandoned project and wasting investment.

Contractors

Contractors have the major responsibility to deal with construction risks. They are responsible for successful risk management of the project (Treceno et al., 2003). A contractor's capability in risk management is one of the key factors to project performance (Wang and Chou, 2003). There has been a trend in construction contracts over the last few years to shift the risks to the contractor (Lynch, 2003), by using contract clauses (Wang and Chou, 2003). If there is no stipulation about the allocation of a certain risk event condition, the client and the contractor would normally have consensus that such risk should be taken by the contractor, particularly as such risks arise from unexpected disturbance by a third party, such as illegal waste disposal, threats by gangs, and requests for contributions to local community (Wang and Chou, 2003). the contract terms and conditions should clearly state the allocation of risks to the various parties. Its

is not sufficient to have vague conditions where it is unclear who is responsible and could lead to misunderstanding. Such misunderstanding could result in disputes with other parties or even project failure.

Risks which the contractor will have to consider, allocate, assume or lay off can arise at all stages from bid agreement through to construction and any follow up maintenance contract (Baartz and Longley, 2003). It is not possible or cost-effective for contractors to carry all risks. Consideration must also be given to the contractor's ability to control and bear the risks (Boothroyd and Emmett, 1996). Better understanding of risks enables allocation to be aligned to the party most able to control them.

Some of the risks associated with the construction process are fairly predictable or readily identifiable; others may be totally unforeseen. Palmer et al. (1996) and Baartz and Longley (2003) consider the risks list from contractors' perspective to include inclement weather; delays in site availability; site conditions; inadequate detail drawings; late material deliveries; unanticipated price changes; subcontractors failure to perform; unproductive labour and strikes; design risk; construction defects; damages, penalties and costs caused by delays in completion of the works. Contractors should also consider the obligations to carry insurance and the capacity to transfer risks to subcontractors, insurers or consultants. When deciding risk management strategies, a contractor must consider many aspects, including risk responsibilities, risk patterns, risk management capabilities (Wang and Chou, 2003).

The risks can be insurable, such as fire, theft, other physical risks; some risks can be transferred to subcontractors or suppliers, such as quality of materials, workmanship; some risks can be shared with clients, such as bureaucratic delays. So risk management is a decision making process for contractors. Contractors have to decide if they should retain, reduce, transfer or avoid risks. A systematic strategy of risk management could provide the contractors with an improved probability of avoiding or mitigating the impact of risks.

Boothroyd and Emmett (1996) believed that a contractor should be adequately compensated for any risks for which he takes responsibility as the most cost-effective route for a client from the insurers' perspective. Traditionally, motivation to insure the works is to fulfill the satisfaction of the client, generally using an insurance policy, e.g. contractors' all risk insurance. Because the clients want to mitigate the loss or damage to the contract works during the construction period and repairing or reinstating them in the event of loss or damage which contractors are obliged in contracts to be responsible for. Moreover, the client needs to be protected against claims arising against the contractor; either by the contractor's employees or by third parties, and usually the contractor indemnifies the client under the contract for such claims arising. The contractor frequently arranges the employer's liability and public liability insurance to alleviate such risks.

Contractors can achieve the correct allocation of risks and responsibilities expressed in the insurance contract. Insurance is a risk transfer tool, which is a major and critical part of an integrated risk management system. Three issues are discussed here:

1) Assessment of risks and needs

The contractor needs to assess the risks to be retained or insured. If insurance policy is not issued accurately according to the risks, it might lead to the lack of indemnity cover by insurers when claims arise. Construction insurance policies must be specially designed to respond to the particular circumstances (Bunni, 2003). It means an insurance policy needs to be specially designed according to the nature of project, the types of procurement and construction contract. In this respect, contractors should be innovative and have the ability to negotiate with the insurers improved conditions of insurance, which are adapted to the changed needs as well as obtain best premium reduction through implementing proper loss control and risk management measures via their experienced expert team.

2) The right insurer and the appropriate insurance policy

A contractor is expected to be familiar with a wide range of construction insurance policies. The contractor should also be aware of the quality of the various insurers in respect of their financial strength / claims paying ability and market reputation. The

quality of insurance can only be tested when the insurer is called upon to pay a justifiable claim.

3) Underwriting and claim settlement

Contractors play an important role in the decision of the value of items to be insured and the negotiation of premium to be paid. Price alone should not be the determining factor in the decision to accept an insurance cover. The standards for contractors to choose insurers include not only premiums, but also service of claim settlement and risk management support. In order to effectively employ construction insurance, contractors must:

- Understand how insurers view the construction industry and developing technology;
- Maintain a good relationship with an insurer who is qualified in construction insurance products;
- Implement effective risk management system, safety management programs and quality control to alleviate risks;
- Maintain a good track record on their performance over the years;
- Improve the understanding of their employees on current insurances.

Insurers

While contractors are mainly responsible for successful risk management of a project, insurers can provide their expertise to assist the contractors' risk management in recognizing potential risks and reducing the probability of such risks. The willingness of insurer to write an insurance coverage reflects favorably on the insured's efforts at safety control, health and environment (Williams et al., 1998).

Construction risks are usually very complex, hazardous and difficult to assess, price and control. It requires insurers to provide the highest quality service of insurance with the help of training, research and up-to-date engineering knowledge and information technology (Heidenhain, 2001). However, not all underwriters like construction insurance, especially Contractors All Risks policies. The reasons are as follows:

- Construction projects too vulnerable to loss (Costner, 2002). For projects embracing many new technologies (especially unproven), or require massive control and organizations, they are more likely to suffer loss (insurable or non-insurable) although it is not true for ordinary construction works. However construction risks in general are more risky than property (static) risks.
- Too many insured (Costner, 2002). There typically includes owner/principle, contractor, sub-contractors, financiers, suppliers/vendors (but for their site activities only) etc.
- Complex risks those are often interrelated. Covers construction/erection risks, third party property and personal injury risks, plant/equipment in premise, storage (theft, fire) etc.
- One chance business. Construction insurance is one-off policy, no renewal applicable likes property policy (issued for every year).

Due to complex characteristics, a construction project is involved many parties and risks. On the other hand, a construction insurers' opportunity lies in the drafting, negotiating, and concluding of bearable long-term, multi-line insurance agreements, sometimes extending over periods in excess of ten years (Heidenhain, 2001). The complex brings huge opportunities and potential for the insurance industry as well.

1) Co-operation with Contractor

Not only the probability and severity of risks but also appropriate risk management system have a significant impact on the insurance premium and the acceptance of the risk. Therefore, sound co-operation should be achieved between all parties since they all share the identical objective of successful and scheduled project completion without losses and within budget (Treceno et al., 2003).

Insurers could recommend appropriate risk management procedures for contractors to:

- Reduce the probability of a risk happening;
- Reduce the size of a claim when it happens;
- Give insurers a better understanding of the risks during underwriting process;
- Increase certainty on financial exposure.

Accompanying a project from as early a stage as possible (not only when problems arise) and throughout construction, erection, testing, commissioning and during the first operating years, provides the engineering insurer with the opportunity to keep in close contact with the risk (Heidenhain, 2001).

2) Premium Dilemma

Insurers compete with each other on services and prices. Insurers are profit driven like in other business, but not market share driven. Nowadays, insurers stick to their underwriting guidelines rather than market share. However, insurers in some developing countries, such as China, may have to match the requirement for developing market share of premiums with a need to charge adequate rates to achieve profit. Because risks are interrelated, insurers should be concerned with both insurable risks and the relevant risks. Relevant influence from other uninsured risks may be a factor when considering the extent of insured risks, but the pricing will center on the exposure on insured risks themselves, i.e. its possibility and severity.

3) Contribution to Risk Management

Insurers can provide their expertise and knowledge based on past experience. They work on the basis of historical precedent, and take particular note of claims processed by them in the past (Anderson, 2000). There is a danger that management will become complacent and blind to hazards, particularly in cases where few losses have occurred in the past (Treceno et al., 2003). Insurers and the described risk management process, i.e. surveys, can assist the owner's risk management in recognising potential hazards and reducing the probability of such hazards (Treceno et al., 2003). The risk management system and nature of risks have a significant impact on the insurance premium. Insured's strong and deep interest in potential risk management development encourages insurers to offer substantial added value, which assists the insured to manage risks. Construction insurers' opportunity lies in having skilled staff available and adequate resources to be able to perform an expert service in insurance and risk management.

4) Involvement in Loss Prevention

In order to reduce incidents and therefore claims, insurers should take an active attitude to assist the insured to control risks for works. The engineer appointed by the insurer should be familiar with the type of projects, be experienced in risk identification and analysis

processes and have the ability to recommend useful solutions. The risk survey should be carried out with the cooperation between the engineer of an insurance company and the contractor. The survey result will help to analyze the past, current and future situations of projects; assist compiling a list of weak points and potential risks; work out measurers for improvement; and increase the awareness to parties involved.

Emerging Issues for Future Research

Motives for Construction Insurance Purchase

The concentrated rebuilding programs in the devastated areas of the world, accompanied by the rapid technological advances which took place in new materials and methods of construction, consolidated the principles of risk, responsibility, liability and indemnity in that area which gave rise, in one way or another, to a greater need for construction insurance (Bunni, 2003). The reasons for the increasing application of construction insurance, especially in developing countries, are as follows:

(1) New Technology

- Advances in technology and construction method made many construction projects prototype. The unproven nature demands cover by insurance.

(2) Legal Aspect

- Increasing construction contracts require the proof of insurance;
- Insurance became a license to do business, especially for mandatory insurance (Kunreuther, 2004);
- Clients, who in many cases were banks and financial institutions, found it imperative to cover their liabilities through insurance (Bunni, 2003).

(3) Safety Consideration

- Insurance can provide a signal concerning a firm's efforts at safety-related activities, such as safety control, health and environment (Williams et al., 1998).

(4) Financial Consideration

- Insurance turns contingent large sum of payment to smoothed and structured pay-out;

- Insurance can reduce the threat of insolvency and the associated costs and safeguard future earnings (Baur and Schanz, 1999);
- Insurance can reduce the tax burden, which can be accounted as a cost before the calculation of tax.

(5) Management Consideration

- The transfer of risks acts as a signal to shareholders that the company is pursuing a responsible risk management policy (Baur and Schanz, 1999);
- Insurers usually offer policyholders other services as well, such as risk identification, planning safety and loss prevention measures, estimating exposures, claims administration and settlement, etc. (Baur and Schanz, 1999).

The usual pooling-of-risks motivation for insurance purchases can usefully be superseded by a transaction-costs theory where insurance offers a low-cost alternative to expensive contingent contracting among the stakeholders of the firm (Main, 2000). The motivations for insurance purchase may include pooling-of-risks, costs of financial distress, informational asymmetries, human capital, taxation, insurer services, and transaction cost theory.

Special Risk Considerations

Construction insurance is used as a collective term to describe various types of policies to protect construction works, erection and operation of machinery. Traditionally it is assumed to be only limited to the construction stage. However, the project is a whole life process, which includes a feasibility study, a call for tender and evaluation of tenders, an award of contract, construction and erection phases, a take-over and maintenance period. Many researchers (Hickson, 1987, Levine, 1991, Palmer et al., 1996, Advanced Study Group No, 1999, Bunni, 2003) discussed all possible insurance policies during the whole project process to build an overall picture of construction insurance.

With the development of construction management and civil engineering, construction insurance products and services have become increasingly specialized since the first Contractors' All Risks policy was issued in 1929 to cover the construction of Lambeth

Bridge over the Thames in London. A special policy was created in Germany in 1934 and started to spread slowly (Wassmer, 1998). Latent defects insurance was introduced as Decennial Insurance by French insurers during the 1980s. Insurance, which are generally required in connection with a construction project, can be divided into two basic categories: property insurance and liability insurance. Recently, it has been extended to cover business interruption during construction process, which is generally termed as Delay in Start-up (DSU) or Advance Loss of Profit (ALOP).

Although it would seem ideal to obtain one insurance policy covering a construction contract, this is not possible because the range of contract risks is vast and insurers specialize in underwriting certain risks (Levine, 1991). Project insurance, sometimes called wrap-up, is an all-embracing insurance for construction projects. Unlike conventional construction insurance coverage where each contractor provides his or her own insurance coverage, project insurance allows the client or contractor of the construction project to purchase an insurance policy covering most parties participating in a given project. It can best represent and protect client's interests, avoid an insurance gap and possibly save on project costs. In the long term, particularly for large projects, more specific project insurances can cover all parties with comprehensive non-duplicating, gap-free cover (Edwards et al., 1996). However, it has some limitations. For example, size is an important prerequisite and dominant factor in determining a project's suitability for project insurance. So a project must be sufficiently large, or at least contain significant labor costs, to make project insurance financially viable. Otherwise, the additional administrative cost generally makes it less worthwhile to use project insurance.

Changing Environment

A second concern is how the construction insurance program evolves to reflect the changing business environment of construction projects, e.g. procurement methods and construction contracts. Construction projects are becoming increasingly complex and dynamic in their nature, and the introduction of new procurement methods means that many contractors are having to rethink their approach to the ways risks are treated within their projects and organizations (Tah and Carr, 2001). Moreover, Griffiths & Armour

(1997) found that the changing nature of projects bring challenges to insurance companies:

- An increasing number of large-scale projects could result in an increasing incidence of shortfall in insurance cover.
- Owners were demanding (and entitled to) a far greater say over the level of premiums and cover arranged on their behalf primarily because insurance costs on major projects represented an increasingly significant cost.
- Increasingly complex projects, e.g. phased hand-over, multi-contract and turnkey projects, etc., rendered the traditional structure of contracts and risk transfer obsolete.
- Ever more remote locations and new state of the art designs meant that underwriters were having to rate a risk with insufficient knowledge.
- Technology had increased the inherent design risk which would fall to the owner who might not be fully aware of this increasing risk
- An increasing number of projects were located in developing and third world countries, many of whom stipulated that insurance cover should be arranged locally in markets unfamiliar with, and incapable of, dealing with such complex and large scale risks. ”

Procurement Methods

The greater the skill and experience, the greater potential the client has to influence building practices and procurement (Potter, 1995). With the development of civil engineering technology and project management, procurement has developed from traditional methods, such as Design Bid Build (DBB), to Construction Management, Management Contracting, Design and Manage, Turnkey (or Design and Build), Build-Operate-Transfer (BOT), Engineering-Procurement-Construction (EPC), Partnering, and Project Controlling. Some particular forms of procurement naturally assist contractors in the insurance of the works and liability risks, e.g. the turnkey method. A given procurement often has its special requirements and preference of construction insurance. For example, BOT/BOO projects require a comprehensive multi-line/multi-year package cover. Single-line specialist insurers run the risk of losing business due to a lack of

flexibility if they are unable to write complex insurance concepts, because of such covers not being common in their standard portfolio (Heidenhain, 2001). Insurers have to obtain more flexibility to fulfill the requirements of new procurement method.
The construction insurance industry undoubtedly remains flexible and adapts itself to changing insurance needs as a result of the huge procurement methods changes, which the construction industry is facing. These needs have been largely brought about by the aftermath of new project finance methods, and the transfer of these risk elements is often imposed by project financiers (Howard, 1997). In order to meet this demand, new insurance solutions have been developed.

Construction Contracts

A works contract is a legal instrument to divide the financial risk responsibility between a client and a contractor (Wassmer, 1998). It not only specifies how risks are allocated, but also obliges the contractor to insure the works against loss or damage. Standard conditions of contract govern the relationships between parties, set out the responsibilities for the risks of loss or damage to the works during construction, and embrace the clauses regarding the obligations to insure. The main conditions of contract between the client and the contractor will normally be the most significant document in allocating risk and insurance responsibilities (Advanced Study Group No, 1999). The contractors assess the risk allocation and fulfill the insurance requirements in the contracts.

Professional associations and institutions have proposed standard forms of contract, such as Joint Contracts Tribunal building contract forms (JCT), Institution of Civil Engineers (ICE), New Engineering Contract (NEC) system of documents, the Fédération Internationale des Ingénieurs (FIDIC) conditions of contract. Each standard form of contract, plus any special additional clauses inserted specifically for the project concerned, must be assessed to determine which party is responsible for what risks, what indemnities are required, what supporting insurances are specified and which are needed, and what deductibles are permitted (Advanced Study Group No, 1999).

The shift of liability resulting from the new contractual requirement for insurance resulted in a more complex web of construction, engineering, statistics, economics, law and insurance.

Each contract has been modified with the development of construction industry. The client depended upon the contractor to maintain adequate insurance under FIDIC 1979 in the past. However, owner-controlled insurance was strongly recommended for large civil engineering projects and the options have been written into the Contract Conditions to allow for this possibility in 1995, because clients can rely on the increasing experience and expertise of their own risk managers to monitor the contractor's insurance arrangements (Griffiths & Armour, 1997).

The understanding of construction insurance in particular project, (in terms of procurement methods, e.g. BOT; in terms of construction contracts, e.g. FIDIC; in terms of project type, e.g. tunneling projects), should be improved. Moreover, construction involves a complex array of interrelationships among the parties working on a project, and details various types of property as well as numerous ownership interests (Cavignac, 2003). Contractors should ensure that insurers to write insurance policies in a right way that can protect their interests.

Interaction to Risk Management

Rendell and Yablonsky (2003) believed that insurance was often proved to be the most cost-effective or most convenient method to manage certain classes of risk, or risks above a certain level. Therefore the first concern is how to evaluate the use of insurance in managing construction risks.

Purchasing insurance from a commercial insurer is still the most widely used method and generally the most cost-effective way to handle low frequency, high severity losses for small to medium-sized public entities (Rendell and Yablonsky, 2003). Because of

statutory and contractual requirements, insurance is a significant part of construction risk management (Edwards et al., 1996). However excessive reliance on insurance, including contractual requirements forcing the purchase of insurance, can lead to higher overall costs of risk in the construction industry (CII, 1993). Construction organizations, particularly contractors, often have no choice but to take up insurance. However, insurance is only one possible option of risk management tools. It needs to be put into context and understood that not every risk can be insured against adequately or insured for a price that is acceptable (Baartz and Longley, 2003). Insurance Task Force (1993) found that clients and contractors must realize that the costs associated with risk financing on projects had become a significant portion of total project cost, and that with proper management and co-operation these costs were controllable. If risk management by insurance cannot be proved to be the most cost-effective of available commercial solutions, contractors would choose other risk financing solutions.

The insured's past loss experience can affect the premium. The insured retains some control over the cost in the sense that loss-prevention efforts can reduce the number of losses and consequently reduce the premium (Williams et al., 1998). To maintain market share, insurers are increasingly taking into account the claims track record of individual construction-related organizations, in order to provide the best possible deal (Edwards et al., 1996). So construction insurance can help the insured to take a positive attitude to risk management.

However, the structure of organizations often creates obstacles to integrated risk management (Williams et al., 1998). Few companies have a full time risk manager and risk management system. On the other hand, the same type of boundaries often appear in the structure of courses offered by academic institutions, leading students to believe that the management of risk is a subtopic of accounting, finance, or human resources (Smith, 1999). Therefore, an integrated risk management strategy should be built from internal and external approaches. Both approaches include knowledge learning, experience sharing, professionals performing and risk management system establishing and implementing. The insurance premium should be based on contractors' safety records and risk management to encourage contractors to take proactive risk management program.

Alternative Risk Transfer (ART) Solutions

Insurance is inevitably a significant part of construction risk management because of statutory and contractual insurance requirements (Edwards et al., 1996). However, insurance is only one possible part of a proactive organization risk management program.

The interaction of increasingly complex construction projects and changing insurance requirements from new procurement and contracts produces a complicated mixture. Contractors wondered if there was a flexible and project specific insurance program to fulfill their demand. Contractors began to demand changes, demand information, make decisions, and insist on rewriting the agents/brokers' role to include education (Davis, 1996). They were no longer satisfied with the available products and services. Contractors took a positive rather than passive attitude in the new relationship with insurers and brokers. In order to provide a more professional service, main construction insurers have a construction department dealing with construction risks with technical and professional expertise relevant to special, complex insurance required by contractors, while many brokers had divisions dedicated to the construction industry. Large contractors in the USA employ a risk or insurance manager to manage their insurance and risk management interests. Contractors gradually realized that they had tremendous opportunities to economically capitalize on new methods of managing their risks (Davis, 1996). The changes brought many new risk financing programs, such as self-insurance, captives, contingent capital, finite risks, catastrophe bond, securitization and derivatives. Alternative Risk Transfer (ART) solutions aim at increasing the efficiency of the risk transfer, broadening the spectrum of insurable risks and tapping the capital markets for additional capacity (Baur and Schanz, 1999).

If construction insurance is not only a solution to transfer risks, the question is when construction contractors should use it. Some factors have influence on the decision. The factors include:

1) Business environment: local financial system, economy development, and legal system;

2) The nature of contractors: years of experience, size of companies, and characteristics of projects, which often carry out, the ability of risk management;

3) The maturity of the insurance industry. Is it capable to provide insurance products and service which can effectively transfer risks from a single contractor and change risks from an uncertain cost to a fixed rate, i.e. premium;

4) Available of other forms of ART, capital market involvement, accounting recognition, tax treatment, regulatory satisfaction and other market & legal concerns.

Conclusions

Construction insurance plays an important role in transferring risks in the construction industry. The future research can focus on the issues of motives for construction insurance purchase, special risk considerations, changing environment, interaction to risk management, and alternative risk transfer solutions. They will contribute a better understanding for both industries, i.e. the insurance industry and especially the construction industry because the changing business environment needs the construction industry to improve its ability to manage construction risks.

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