RISK MANAGEMENT IN ROAD CONSTRUCTION: THE CASE OF SRI LANKA

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ABSTRACT. Risk is an unavoidable phenomenon in construction projects. Proper risk allocation in construction contracts has therefore come to assume prominence because risk identification and risk allocation have a clear bearing on risk handling decisions. The proper management of risks requires that they be identified and allocated in a well-defined manner. This can only be achieved if contracting parties comprehend their risk responsibilities, risk event conditions, and risk handling capabilities. This research aims at identifying the risk responsibilities of contractual parties in order to improve their risk handling strategies with regard to Sri Lankan road projects. Semi-structured interviews were used for the primary data collection. This was complemented with documentary evidence. The results show that road construction projects in Sri Lanka are exposed to many risk sources while most risks are borne by parties who were assigned with risks via contract clauses. However, parties not allocated with risks too happened to bear the consequences of such risks. Therefore, it is concluded that there is no *one* best way to respond to a risk and that different risk handling strategies should be adopted in order to deal effectively with risks.

KEYWORDS: Risk allocation; Risk handling; Risk identification; Road construction projects; Contractual parties

1. BACK GROUND

Every human endeavor involves risk (Dey and Ogunlana, 2004; Poh and Tah, 2006). The success or failure therefore of any venture depends crucially on how we deal with it (Dey, 2001). The construction industry is more prone to risk and uncertainty than most other industries (Flanagan and Norman, 1993; Kim and Bajaj, 2000; Tah and Car, 2000), the element of uncertainty having to do with its inherent characteristics (Hayes et al., 1986; Bunni, 1997; Kangari and Riggs, 1989; Bing et al., 1999). But these risks are not always dealt with properly by the industry (Thomson and Perry, 1992; Mills, 2001).

According to Mills (2001), the productivity, performance, quality and cost of the project are affected by the risk. Edward and Bowen (1998) identified risk management as an im-

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portant tool to cope with construction risks and to overcome above problems of a project. Dey (2002) also shows that there are many examples of non-achievement of time, cost and quality of projects due to the absence of risk management techniques in project management. Therefore, the success parameters of a construction project, namely, the timely completion, staying within the specified budget, and achieving requisite performance would depend upon the capability of each party in risk management. Baker et al. (1999a) argued that risk management is also useful in maximizing profits. The construction industry however has been very slow in moving towards understanding the benefits of risk management (Flanagan and Norman, 1993; Raftery, 1994; and Ward et al., 1999).

The Road Development Authority (RDA) of Sri Lanka, due to the ever-increasing traffic volume, is planning for the future development of a national highway network (RDA, 2006). Road projects however often confront many uncertainties due to factors such as the presence of interest groups, resource availability, the physical, economic and political environments, statutory regulations, etc. According to Wang and Chou (2003), such risks have a significant effect on the outcome of a road construction process.

Proper risk allocation in construction contracts will reduce the impacts of adverse conditions, and increase efficiency and effectiveness in management (Barnes, 1983; Abrahamson, 1984; Thompson and Perry, 1992; McCallum, 2000; Rahman and Kumaraswamy, 2002). Risk allocation upon risk handling of road projects in Sri Lanka has not been satisfactorily established because of different interpretations of risk allocation between owners and contractors. This research highlights the significance of understanding proper risk allocation between contractual parties in Sri Lankan road projects. It aims at assisting Sri Lankan road contractors and employers to a) identify the risk sources inherent in road projects, b) understand their risk responsibilities, and c) improve their risk handling strategies so that they would optimize the scarce resources and enhance the socio-economic value of Sri Lankan road projects. Section 2 of this paper discusses the literature pertaining to risk management in construction highlighting risk identification, risk allocation and risk handling. Section 3 gives the research methodology followed by results in section 4. Section 5 concludes the paper with a discussion on risk handling techniques to be followed in road projects.

2. THE LITERATURE ON RISK MANAGEMENT IN CONSTRUCTION

Bufaied (1987 cited in Akintoye and Macleod, 1997) has described risk in relation to construction as “a variable in the process of a construction project whose variation results in uncertainty as to the final cost, duration and quality of the project”. According to Dey (2001), such variation is due to the absence of risk management techniques in project management. Hence, risk management, as defined by Toakley (1989 cited in Uher and Toakley, 1999) describes a procedure which controls the level of risk and mitigates its effects. A number of scholars have come up with definitions of risk management (Boehm, 1991; Edwards, 1995; Jaafari et al., 1995; Kerzner, 2001; Chapman and Ward, 1997; Edwards and Bowen, 1998; Hastak and Shaked, 2000; Lyons and Skitmore, 2004; Project Risk Management Handbook, 2003; Gray and Larson, 2005). The proposed definitions divide the risk management process into a number of steps which varies from three steps to more. However, the definitions are consistent in recognizing risk identification, risk analysis, and risk handling/ risk response as the key steps of the risk management process. Only the important elements of this procedure are discussed in terms of their relevance to the stipulated objectives of this research.

2.1. Risk identification and classification

Hayes et al. (1986), Williams (1995), and Godfrey (1996) have seen risk identification as the first important step in the risk management process. Dawood (1998) has shown that systematic risk management enables the early detection of risks. This eliminates the need for contingency plans to cover almost every eventuality. Risk identification involves identifying the source and type of risks. According to Flanagan and Norman (1993), an identified risk is no longer a risk but a management problem. It has also been pointed out that a bad definition of a risk may precipitate other risks. Therefore, obtaining a clear view of the risk event is the first step when focusing on the sources of risk and their potential effects.

Classification of risks entails identifying the type, consequence and impact of risk. Wiguna and Scott (2006) have derived a risk hierarchy under four risk categories: external and site condition risks, economic and financial risks, technical and contractual risks, and managerial risks. This classification of risks adopted in this study. According to Bunni (1997), when a risk has been identified, assessed and analyzed, it must be allocated to various parties in order to keep it under control and to prevent the occurrence of harmful consequences.

2.2. Risk allocation

Andi (2006) has argued that "construction risks, can hardly ever be eliminated. They can merely be transferred or shared from one party to another through contract clauses". This is supported by Mak and Picken (2000) who emphasize the fact that contractors should be ready to accept a certain level of risk due to unforeseen costs they incur during construction and that risk is also an issue for clients. Such allocation of risk becomes part of the risk management process.

Thompson and Perry (1992) suggest that a carefully drawn up contract will ensure the right allocation of responsibilities in the same way as the procedure which determines the type of contract and the tendering procedure for a project. It will define the role of each constituent in the contract, such as the contract agreement, conditions of contract, specifications, preamble notes, bills of quantities and drawings, etc., which determine the allocation of risks. Although risks can be transferred beyond the limits of contract clauses that can only be with the concurrence of both parties as seen in the study by Wang and Chou (2003).

A party to whom a risk is allocated is considered to have the "ownership of risk," which according to Uff (1995) and Godfrey (1996) has several meanings: a) having a stake in the benefit or harm that may arise from the activity that leads to the risk; b) responsibility for the risk; c) accountability for the control of risk; and d) financial responsibility for the whole or part of the harm arising from the risk should it materialize. Kartam and Kartam (2001) have argued that all the risks should rightfully reside with the owner and transfer to another party should entail fair compensation. However, the common understanding on risk allocation has it that the receiving party has both the competence and expertise to fairly assess the risk and to control or minimize it (Hartman, 1996; Fisk, 1997; Godfrey, 1996; Perry and Hayes, 1985).

2.3. Risk handling/risk response

Risk handling by lessening their impact is a critical component of risk management. Managers need to realize the contents and effects of all alternatives before making decisions about an appropriate strategy for risk handling (Wang and Chou, 2003). Risk handling is the choice of a proper strategy to reduce the negative impact of the risk (Miller and Lessard, 2001). It is defined as the first step in risk control by Baker et al. (1999a). But Kim and Bajaj (2000) define risk handling/response as the way risk issues are dealt with. According to Flanagan and Norman (1993), risk response refers to how the risk should be managed either by transferring it to another party or by retaining it. Further, risk handling principles are classified mainly into four categories, i.e. risk retention, risk reduction, risk transfer and risk avoidance (Carter and Doherty, 1974; Flanagan and Norman, 1993; Raftery, 1994; Baker et al., 1999b; Dey, 2001; Wang and Chou, 2003). Wang and Chou (2003) see risk handling strategies as consisting of one, or a combination, of the above methods. Studies have proved the validity of various strategies chosen on the basis of individual projects. However, the study by Fan et al. (2008) has established that the risk-handling decisions of a project are determined by project characteristics (e.g. project size, slack, unit prevention cost, risk situation, etc.).

3. METHODOLOGY

The research adopted the Multiple Case Studies approach. According to Yin (1994), multiple case studies validate results through replication as the approach uses different cases. Further Yin stresses that the criteria for selecting cases is a matter of discretion and judgment, convenience, access and to be those which are subjective for purpose of the research. Therefore this research focused on two mega foreign-funded road projects which were near completion to avoid complexities which may arise in evaluating different types of road projects simultaneously. Projects which adopt traditional procurement method with ad-measurement were selected as it is the most widely used procurement method used in Sri Lanka. The cases selected on the basis of having a project duration of about twenty four months or more, as researchers believe that a longer period is necessary to get risk related information. The Table 1 gives the details of the two cases.

Multiple sources of evidence comprising semi-structured interviews, documents such as letters, weather records, bill of quantities, claim reports, non-conformity reports, variation orders, project programme, public complaint reports, certified monthly bills and monthly progress reports, and archival records such as past weather records were used in this study for data collection. Triangulation, which is the rationale behind the use of multiple sources of evidence, has been addressed here. According to Love et al. (2002), the triangulation approach is useful since it enables both qualitative and quantitative data to be used in generalizing the findings.

The data was analyzed through the content analysis method. The software QSR NVivo1.0 was used to codify interview transcripts. The results were arrived at after a cross case analysis.

Table 1. Details of cases

Characteristic	Case A	Case B
Road classification	Class A	Class A
Name of the employer	RDA	RDA and Ministry of Highways
Length of the road	80 km	95 km
Construction period	24 months	36 months
The original contract sum	$ 10million	$ 11million
Procurement method	Traditional ad-measurement	Traditional ad-measurement

4. RESULTS AND FINDINGS

4.1. Risk sources associated with road projects

The study began with 26 risk sources which were gathered through the literature review and through interview transcripts. However, it was found that only 23 risk sources were pertinent to the two cases. The 23 risk sources have been classified in Figure 1 under four types of risk sources in order to formulate a risk classification framework based on the literature review.

There were only two risk sources that were not common to the two cases out of identified 23 factors. They were delayed payments and insufficiency in the preliminaries bill. There had been a delay in two interim payments and the contractor's facilities had not been included in the preliminaries bill in one case.

All other risks were common to both the cases. Construction activities had to be halted for a few days after the Tsunami disaster. With regard to the other, the reason had to do with earth slips. This could be classified under Acts of God. The impact of adverse weather conditions was such that materials had been washed away and critical work affected by the unexpected rainfall. In addition, changes imposed by the Engineer, dealings with utility agencies, late handing over of the site and late approvals too caused significant difficulties to the Contractor.

The risk of defective design and scope change cannot be underestimated because this would lead to poor performance of the completed road. The dependence on foreign funds too was a risk as the contract sum in both projects had exceeded the forecasted sum while the amount of funds was limited. Insufficient estimation was a risk mainly because price escalation had not been considered for recurrent preliminary items. The increase in the contract sum by more than fifty percent was due to inflation. Legislative changes were also significant since there had been a change in the labour act which required the salaries of labourers to be increased and fuel adjustment charges on electricity bills.

Special attention was also paid to the risks of low labour and equipment productivity and procurement of resources. With regard to relations with neighborhood, many complaints had been received from the neighbourhood such as house damage due to cracks, damages to boundary walls and access paths, the problem of land fill, endangerment of houses due to land cutting, accumulation of waste in paddy

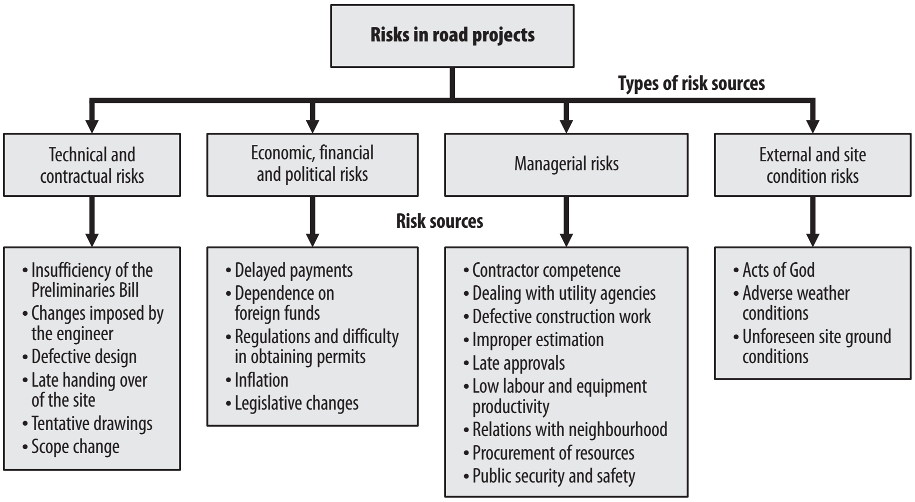

Figure 1. Risk classification framework

lands, etc. The risk of public security and safety was also high in this type of infrastructure project. Both the regulations and the difficulty in obtaining permits was also a risk as the projects were required to obtain permits for the use of explosives in road works and in the quarry. The contractor had to pay royalty too for the quarry because it had been forest land. Scope change and tentative drawings were the risks that contributed the most to the cost and time overrun in both cases. Increase in the road width, change in the road surface from Double Bituminous Surface Treatment (DBST) to asphalt paving in one case, and the addition of a binder course layer and the introduction of a hard shoulder instead of the earth shoulder in the other case were due to the change in scope. Finally, the risk of unforeseen site ground conditions was significant due to the difficulty in identifying underground cables, or due to changes in sub-grade requiring the use of rock fill or type-1 soil in areas where the water table was high and extra excavations for places where soil conditions were weak.

Having identified risk sources, their proper allocation becomes necessary to apportion the risk responsibilities of the parties.

4.2. Actual risk allocation vs. risk allocation through contract clauses

The Conditions of Contract that had been used in both projects was FIDIC the one published by the International Federation of Consulting Engineers (FIDIC, 1987). Since risks are allocated to contracting parties through contract clauses, the administration of construction risks was first analysed with the aid of the Conditions of Contract which had been used in the two cases. Since the Conditions of Contract used in the two cases was the same, there was an identical basis for the analysis. Secondly, the actual allocation which is the allocation of risks beyond the contract clauses but within the consensus of contracting parties is identified and these risks were also analysed in line with the views of respondents and in particular the archival sources (refer Table 2).

It was found that actual risk allocation and risk allocation through contract clauses were the same for majority of risk factors, although the risk of Acts of God becomes a risk to the Employer through the sub-clause 20.4 (h) [*Employer's Risks*], it was revealed that the Contractor too had to share in this risk. Similarly, though the risk of late handing over of the site had been allocated to the Employer under the sub-clause 42.2 [*Failure to Give Possession*], the Contractor too had to share this risk because of irrecoverable difficulties he had to face. The Employer had borne the risk of scope change in both projects as in sub-clause 52.3 [*Variations Exceeding 15 per cent*], while the Contractor too had to carry a certain risk due to delays in the completion of the project. In other words, in the three instances cited, the risks had been shared by both parties though the allocation was only to the Employer according to contract clauses.

According to sub-clause 20.4 (g) [*Employer's Risks*], Defective Design, that is, loss or damage to the extent that it is due to the design of the Works rather than any part of the design provided by the Contractor or for which the Contractor is responsible, constitutes a risk to the Employer. However, the risk also lies with the Contractor according to the sub-clause 8.1 [*Contractor's General Responsibilities*]. However in both cases this risk had been transferred to the Consultant through a separate agreement between the Employer and the Consultant since the Consultant had been appointed as an independent party. Moreover, it could be seen that the Employer in one case had taken measures before the start of the project to eliminate design defects. Accordingly, this risk had been shared by all three parties in actual fact. In accordance with sub-paragraphs (a), and (b) of sub-clause 19.1 [*Safety, Security and Protection of the Environment*] and the sub-clause 22.1 (a) [*Damage to Persons and Property*], the risk of public security and safety lies with the Contractor and as in the sub-clause 23.1 [*Third Party Insurance*], it is a risk to both the Employer and Contractor. With regard to the two cases, it could be clearly seen that this risk was borne by the two parties including the Consultant.

The risk related to unforeseen site ground conditions has been allocated to both the Contractor (through the sub-clause 11.1 [*Inspection of Site*]) and to the Employer (through the sub-clause 12.2 [*Not Foreseeable Physical Obstructions or Conditions*]). Again, it was evident that this risk had been shared by all three parties. The risk of late approvals is allocated to the Engineer as per the sub-clause 37.3 [*Dates for Inspection and Testing*], but it was the Employer and the Contractor who happened to carry the risk. Although the risk of tentative drawings is assigned to the Contractor according to the sub-clause 7.1 [*Supplementary Drawings and Instructions*], all three parties had borne this risk in the two case study projects.

Table 2. Actual risk allocation vs. risk allocation through contract clauses

Sources of risk	Risk allocation		
	Employer	Contractor	Engineer
1. Acts of God	● ○	○	
2. Adverse weather conditions	● ○	● ○	
3. Changes imposed by the engineer	● ○	● ○	
4. Contractor competence		● ○	
5. Dealing with utility agencies	● ○	● ○	
6. Defective construction work		● ○	
7. Defective design	● ○	● ○	○
8. Delayed payments	● ○		
9. Dependence on foreign funds	● ○		
10. Insufficient estimation		● ○	
11. Inflation	● ○	● ○	
12. Insufficiency of the Preliminaries Bill		● ○	
13. Late approvals	○	○	●
14. Late handing over of the site	● ○	○	
15. Legislative changes	● ○		
16. Low labour and equipment productivity		● ○	
17. Relations with neighbourhood	● ○	● ○	
18. Procurement of resources		● ○	
19. Public security and safety	● ○	● ○	○
20. Regulations and difficulty in obtaining Permits	● ○	● ○	
21. Scope change	● ○	○	
22. Tentative drawings	○	● ○	○
23. Unforeseen site ground conditions	● ○	● ○	○

Note: ● – Actual risk allocation; ○ – Risk allocation through contract clauses

Table 2 shown above compares the actual risk allocation (denoted by the dark circle – ●) against risk allocation through contract clauses (denoted by the light circle – ○).

4.3. Proposed risk handling framework

Having considered the allocation of risks between contracting parties all actual handling of those risks, a risk handling framework was developed. Semi-structured interviews with documentary evidence were used for this task. This allowed the researcher to ask for the facts as well as for the respondent's opinions about an event. Respondents were allowed to disclose the current handling methods and also propose their own views regarding possible handling of these risks. These results are summarized in Table 3. In developing this framework, the risk sources were categorized into four types initially. The actual allocation of risks, which was identified using the case study approach is shown against each risk source along with the risk response that could be used in dealing with it. The last column provides the risk handling actions that could be adopted for the relevant risk response.

5. CONCLUSIONS

The research was initially begun with twenty six risk sources. However, during the analysis it was found that there were a few risks that were not relevant to the two cases under study. The observance of real cases, as the literature on the subject demonstrates reveals the extent to which the environment determines construction work and the many risks to which they are exposed throughout the entire process.

With regard to Acts of God, it is evident that they are specific to the geographical location of the construction project, so that any party to a contract is expected to identify the probability of occurrence of such events. Similarly, the effect of the dependence on foreign funds was also specific to each project as the terms of the funding arrangement are not the same.

Risks of defective design, late approvals, late handing over of the site, tentative drawings and unforeseen site ground conditions had thwarted the Contractor on many occasions. Moreover, relations with neighbourhood and public security and safety were also very important in pursuing these social capital development projects. Inflation and scope change can also be cited as factors that determine the failure of the parties concerned to confine themselves to the cost and time limits of the two cases. Therefore, these risks are identified as very vital.

Another important aspect in risk identification is that the contractual parties should adopt a continuous learning approach. Past projects and past events are real-life scenarios from which to gain experience that might stand the parties in good stead in the future so that probable risks that might be encountered in a new project can be identified beforehand and measures taken in order to avoid triggering those risk events. Thus, it was felt that early identification of a risk source was essential for its proper allocation.

It is a fact that the employer allocates construction risks through contract clauses before the contract is awarded. This should encourage Contractors to obtain a clear understanding of the risks they are allocated with. Disagreements may also occur from the absence of related contract clauses, unclear stipulations, and queries on the fairness of risk allocation. In such situations, though certain risks had been allocated specifically to a party through contract clauses, it might transpire that the other parties too might have to bear consequences that have arisen because of those risks. Risk sharing by the contract team has proven to be more effective in dealing with such risks.

Table 3. Risk handling framework

Risk source	Risk allocation	Risk response	Risk handling action
Technical and contractual risks			
i). Insufficiency of the preliminaries Bill	Contractor	Risk avoidance	Consideration of general items that had not been covered in the Preliminaries Bill at the bidding stage
			Taking into account the likely amount of price escalation at the bidding stage for recurrent preliminary items for which price escalation is not paid
ii). Changes imposed by the engineer	Employer & contractor	Risk avoidance	Early attendance to identify likely changes so as to incorporate them before the start of works (public participation is essential)
			Agreeing on overhead and profit component at the project initiation for new items which might come up during construction
	Contractor	Risk transfer	Claiming for variations
			Keeping written records of instructions
iii). Defective design	Employer	Risk mitigation	Conduct of a design review
	Contractor	Risk avoidance	Communicating any design defect in advance to the Engineer in writing
	Engineer	Risk transfer	Recovery of any damage through his Professional Indemnity
iv). Late handing over of the site	Employer	Risk retention	Employing outside specialists in the absence of in-house skills
		Risk mitigation	Handing over of the site to the Contractor in its existing condition and not waiting till the land acquisition is completed fully
	Contractor	Risk transfer	Claiming for the number of delayed days
			Claiming for the idling cost of labour, equipment, mobilization and demobilization
		Risk mitigation	Leaving the locations that had not been acquired and working elsewhere
v). Tentative drawings	Contractor	Risk mitigation	Informing the Engineer whenever a design change is found
vi). Scope change	Employer	Risk retention	Use of unallocated funds or money of the Treasury in financing the increased amount
		Risk mitigation	Confining to the old profile of the road which results in a huge cost saving
	Contractor	Risk transfer	Claiming for an extension of time (EOT)

(Continued)

Risk source	Risk allocation	Risk response	Risk handling action
Economic, financial and political risks			
(*Continued*)			
i). Delayed payments	Employer	Risk retention	Paying interest on delayed payments and acting promptly in future so as to avoid a recurrence
ii). Dependence on foreign funds	Employer	Risk avoidance	Reducing the scope so as not to exceed the limited funds
			Conducting a design review and identifying alternate methods of construction to eliminate high cost items from the scope
iii). Regulations and difficulty in obtaining permits	Employer & contractor	Risk mitigation	Working together to obtain permits for the works
	Contractor	Risk avoidance	Examining the rules and regulations applicable in the area of the project and reflecting on their cost implication when estimating
			Using borrow pits in private lands and disposing excavated materials in the same with the written authority of land owners
iv). Inflation	Employer	Risk mitigation	Reducing the scope so not to exceed the limited funds
		Risk retention	Use of reserved funds and money of the Treasury to pay for price escalation
v). Legislative changes	Employer	Risk retention	Requesting the Contractor to produce evidence for the payments to labourers and consumption of diesel for the months during which these were not reflected in price indices
	Contractor	Risk retention	Having to retain the additional cost of supportive staff included as preliminary items
Managerial risks			
i). Contractor competence	Employer	Risk avoidance	Obtaining the Performance Bond from the Contractor
	Contractor	Risk mitigation	Having a long-standing stake with employees and sub-contractors which encourages good workmanship
			Regular monitoring and strict supervision of the workmanship of both subcontractors and their own.

(*Continued*)

Risk source	Risk allocation	Risk response	Risk handling action
Managerial risks			
(*Continued*)			
ii). Dealing with utility agencies	Employer	Risk retention	Paying for the shifting of services
		Risk avoidance	Incorporating any existing service into the design if the cost of shifting is unbearable
			Taking away work from the custody of authorities with their consent if their response to that particular work causes a delay
		Risk transfer	Claiming damages from utility agencies when they are responsible for damages
		Risk mitigation	Commencement of shifting of services few years prior to the start of the project
			Conducting meetings with utility agencies at regular intervals
	Contractor	Risk mitigation	Planning work in an alternate place if obstructions are met, thus causing a skip in locations
		Risk avoidance	Advising workers on taking care over work so as to avoid damage to any utility appurtenances
iii). Defective construction work	Contractor	Risk mitigation	Cooperating with the Engineer in changing the design of any defective work wherever possible
			Reuse of material for any other possible work if it becomes unsuitable for the intended work
		Risk retention	Urging the Engineer to rethink the adequacy of the completed work in fulfilling the intended function before determining whether defective work should be demolished
iv). Late approvals	Contractor	Risk avoidance	Taking prior approval to proceed with works
		Risk mitigation	Keeping alternate locations handy to work in case work is delayed due to absence of approval
			Encouraging the Engineer to ensure the presence of laboratory staff at the right time
		Risk transfer	Keeping written records about the time of informing the laboratory staff to do a test and the time of arrival, so the delay can be quantified and claimed
		Risk avoidance	Remaining steadfast in the belief in "No work without the consultant's supervision"

(*Continued*)

Risk source	Risk allocation	Risk response	Risk handling action
Managerial risks			
(*Continued*)			
v). Low labour and equipment productivity	Contractor	Risk mitigation	Assigning labourers with targets and providing incentives to motivate them
			Maintaining a close supervision on workers' performance
		Risk avoidance	Recruiting labourers possessing vocational training qualifications
			Drawing up labour contracts
			Possessing enough and efficient equipment
vi). Relations with neighbourhood	Employer	Risk mitigation	Appointment of officials to attend to public complaints and a committee to attend to third party damage
		Risk retention	Provision of safety measures for the public
			Provision of basic facilities which had been removed due to construction taking into consideration the human needs
			Reinstatement of access roads which had been obstructed
	Contractor	Risk mitigation	Taking a middle-of-the-road approach to avoid unnecessary dealings
		Risk avoidance	Inspection of houses for cracks prior to the start of the roadwork so as to avoid unreasonable claims
			Continuous inspection of houses where the relatedness of reported cracks to road works is in doubt
			Rejection of claims for house cracks which are due to improper construction
		Risk transfer	Insurance of third party property and bodily damages
vii). Procurement of resources	Contractor	Risk retention	Subcontracting of works
			Having one's own machinery and plant
			Looking for the easiest ways to procuring methods
viii). Public security and safety	Employer, contractor & engineer	Risk mitigation	Provision of barricades and other safety measures
			Regular safety inspections and night inspections for safety arrangement
			Appointment of safety officers and safety assistants

(*Continued*)

Risk source	Risk allocation	Risk response	Risk handling action
External and site condition risks			
(*Continued*)			
i). Acts of God	Employer	Risk mitigation	Cooperation with the Contractor
		Risk retention	Allowing an EOT to the Contractor
		Risk transfer	Transferring the cost of removal of debris from earth slips to an insurer
	Contractor	Risk retention	Release of equipment for immediate reconstruction work after the tsunami
ii). Adverse weather conditions	Employer	Risk retention	Allowing an EOT to the Contractor
			Compensating parties affected because of measures taken against the effects of weather
	Contractor	Risk transfer	Claiming material damages from insurance
		Risk retention	Keeping costs of material damages below the deductible amount of the insurance policy
iii). Unforeseen site ground conditions	Employer	Risk avoidance	Allocation of adequate provisions to fill materials in areas where the soil condition is weak
	Contractor	Risk transfer	Recovering underground cable damage from the insurer
			Rejecting claims for damage to underground cables which had not been laid according to the required standards

It could also be observed that some risks could be effectively reduced with corporation among the parties concerned, for example, risks arising from Acts of God, with utility agencies, in relations to neighbourhood, in public security and safety issues, pertaining to regulations and the difficulty of obtaining permits. Intervention of the Employer, who represents the government, is essential when dealing in particular with neighbourhood, public security and safety issues.

Transfer of risks is also an important risk response method because it could act as a defense against certain losses and to achieve the organizational objectives of each party. Contractors however were reluctant to forward claims for losses in order not to harm the good rapport with the Employer. In this instance the involvement of insurers is significant.

Risk avoidance, which is considered the most effective risk handling method, can be achieved with the early detection of events, possibly at the estimating stage, and by keeping written records and giving written notices of possible negative events to the Engineer. It is also evident that the effects of risks that were to be retained by a particular party would be minimal if that party were to handle it using other methods. It is also to be noted that there is no one best way to deal with risk and different handling methods would have to be employed depending on the type and nature of the risk.

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SANTRAUKA

RIZIKOS VALDYMAS TIESIANT KELIUS: ŠRI LANKOS ATVEJIS

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Rizika – neišvengiamas statybų projektų reiškinys. Todėl svarbus tapo tinkamas rizikos paskirstymas statybų rangos sutartyse, nes rizikos nustatymas ir rizikos paskirstymas daro akivaizdžią įtaką rizikos valdymo sprendimams. Norint gerai valdyti riziką, reikia ją nustatyti ir tinkamai paskirstyti. Tai įmanoma tik tuomet, jei sutarties šalys supranta savo atsakomybę už riziką, rizikos atvejų sąlygas ir rizikos valdymo galimybes. Šiame tyrime, siekiant pagerinti sutarties šalių rizikos valdymo strategijas, mėginama nustatyti, kokią atsakomybę už riziką prisiima sutarties šalys pagal Šri Lankos kelių tiesimo projektus. Pirminiai duomenys surinkti iš pusiau struktūrinių interviu. Jie papildyti dokumentiniais įrodymais. Iš rezultatų aiškėja, kad kelių tiesimo projektai Šri Lankoje imlūs daugybei rizikos šaltinių, o daugelį rizikos rūšių prisiima šalys, kurioms riziką priskiria sutarties nuostatos. Tačiau šalys, kurioms rizika nėra priskirta, kartais irgi patiria tokios rizikos pasekmių. Todėl daroma išvada, kad nėra vieno geriausio būdo reaguoti į riziką ir kad reikia taikyti įvairias rizikos valdymo strategijas, siekiant efektyviai spręsti rizikos situacijas.