Chapter 4
Results and Discussion

4.1 Introduction

The aim of this study is to determine the risk factors in construction industry, allocation of these factors, methods used to deal with risks and the techniques adopted in analyzing these risks. The results of the study are illustrated in this chapter. Mainly, the severity of risk factors, allocation of each, methods of dealing with risks and techniques of analysis. Then, a comparison will be held between contractors and clients ' perspectives regarding the severity and allocation of each risk factor. Also, in this chapter the results and findings of this research are discussed in detail

4.2 Risk factors – *Contractors' perspective*

As mentioned in chapter 3, the questionnaire included 44 risk factors, which have been categorized in nine main groups, these groups were: physical group, environmental group, design group, logistics group, financial group, legal group, construction group, political group and management group. The factors of each group will be demonstrated in the terms of severity and allocation according to the participants answers..

4.2.1 Physical group (Group 1)

4.2.1.1 Severity

Results verified that the supply of defect materials is the most important risk in the physical group (Table 4.1), occurrence of accidents was the second from importance and the third was the variation in labor and equipment productivity. These results indicate the concerns of contractors about suitability of materials and safety measures; this result is supported by the results of Ahmed, et al. (1999) and the findings of National Audit Office (2001) which considered the risks of defect materials and safety measures as very important risks.

4.2.1.2 Allocation

The criterion for a risk to appropriated to a particular category (client, contractor, shared, insurance or ignored), was that it should get at least (60%) response rate to achieve the mainstream of the rates. Those that failed to get such response rate in favor of any category were listed as undecided. As shown in Figure (4.1), (39%) of contractors tried to shift the consequences of accidents to other parties such as insurance, (42%) of contractors appeared to be ready to bear these consequences and (19%) of them seemed to share these consequences with owners. That means that contractors are undecided about the allocation of safety risks as well as Hong Kong contractors (Ahmed et al, 1999) and unlike Kuwait contractor who

accepted to bear the safety risks (Kartam, 2001). In fact contractors are better able to control such risks by supervising the application of safety precautions inside the construction sites. Moreover, the existence of insurance premiums for accidents and injuries can mitigate some of this risk consequences. Contractors should consciously pay more effort to mitigate the accidents costs and other consequences by applying effective training and increasing awareness of safety precautions. The majority of contractors (97%) accepted the risks of supplying defect materials and variation in productivity (71%). In fact, not only did contractors designate them as their responsibilities, but most researchers also support this position (Oglesby cited in Kartam, 2001). Also, contractors of Hong Kong confirmed this allocation (Ahmed et al, 1999)

.

Table 4.1. Physical group risks ranking

No.	Physical Group Risks	Weight	Severity (1-10)
2	Supplies of defective materials	239	7.7
1	Occurrence of accidents because of poor safety procedures	221	7.1
3	Varied labor and equipment productivity	188	6.1

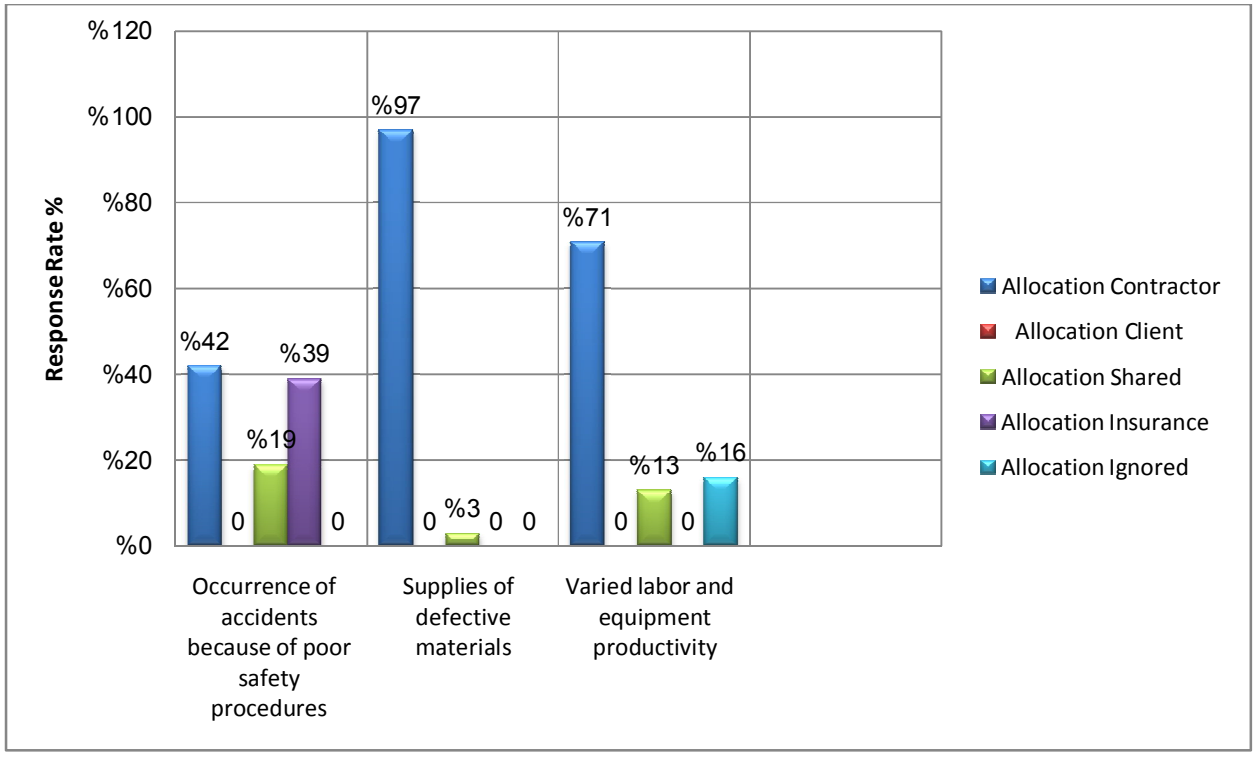

Figure 4.1. Physical group risks allocation, contractors' perspective

4.2.2 Environmental group (Group 2)

4.2.2.1 Severity

As seen in Table (4.2), contractors considered site accessibility as a main cause of delay; in addition they considered the risk of adverse weather conditions to be a medium risk. These risk categories increase the probability of uncertain, unpredictable and even undesirable factors in the construction site. However, the risks of adverse weather conditions and site accessibility did not appear with high significant risks among the surveyed risks.

Environmental factors (catastrophes) occurred hardly ever , that is why the weight of the risk of Environmental factors was relatively low. These results are supported with the outcomes of (Kartam, 2001).

4.2.2.2Allocation

Figure (4.2) demonstrates that contractors were not decided on the allocation of risk of Environmental factors . Moreover, a great share of contractors (39%) decided to ignore its risk. On the other hand Smith & Gavin (cited in Ahmed et al, 1999) suggest that it should be a shared risk, such events are not predictable. Risk of site access was considered as a shared risk (share the risk between the client and the contractor) by the majority of contractors (71%), as a matter of fact, site access risk need to be borne by the client whoshould evaluate the needs during the planning phase (Smith & Gavin, cited in Ahmed el al ,(1999 ,but due to the ongoing tense situation, contractors and clients have to coordinate their efforts to get a best handling of such risks. 52% of contractors supposed to share the risks of adverse weather conditions, (13%) supposed contractors to bear this risk; in other words they were not decided on this risk's allocation, in fact, and through the review of some types of contracts that are used in Gaza Strip, most owners of the construction projects in khartoum are legally protected from liability of this risk via assigning some exculpatory clauses in their contracts, but it is known that weather conditions are out of control and such risk should be shared to get better handling and to reduce conflicts probabilities.

Table 4.2. Environmental group risks ranking

No.	Environmental Group Risks	Weight	Severity (1-10)
5	Difficulty to access the site (very far, settlements)	207	6.7
6	Adverse weather conditions	173	5.6
4	Environmental factors	160	5.2

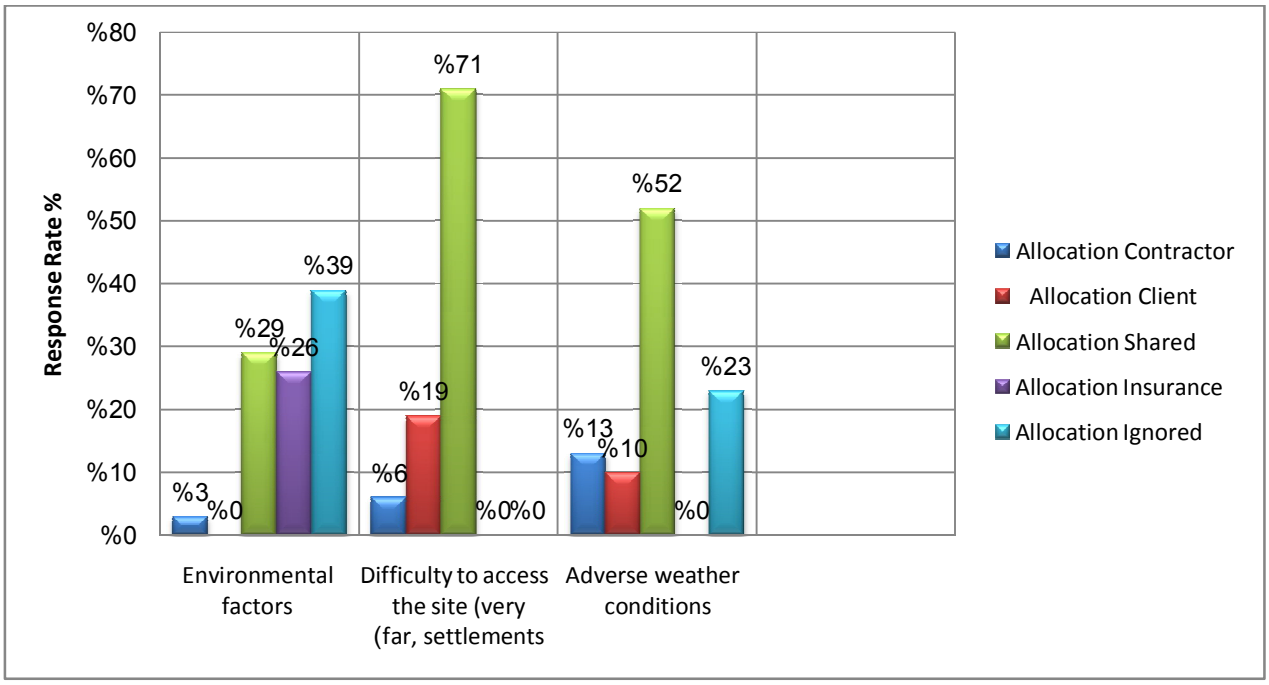

Figure 4.2. Environmental group risks allocation, contractors perspective

4.2.3 Design group (Group 3)

4.2.3.1 Severity

Design group factors included one of the most important surveyed risks. As illustrated in Table (4.3), defective design with (8.5) severity and lack of awarding the design to unqualified designer with (7.8) severity are the most important factors. These results also show that contractors suffer from insufficient or incorrect design information. This result was obtained from ranking the defective design risk category as one of the five most significant risks to project delays. These results complied with the results of Kartam (2001), (Lemos et al, 2004) and (Shen, 1997). It has to be noted that contractors concerned about defective design issues because they could be responsible about any critical issues could happen due to incorrect design. Respondents assigned the risks of un-coordinated design and lack of coordination in design as high significance risks, on the other hand these risks can be overcome by paying true attention and coordinate correctly between design disciplines. Other design risk factors considered medium risks by contractors.

Table 4.3. Design group risks ranking.

4.2.3.2Allocation

No.	Design Group Risks	Weight	Severity (1-10)
7	Defective design (incorrect)	264	8.5
12	Awarding the design to unqualified designers	243	7.8
8	Not coordinated design (structural, mechanical, electrical, etc.)	225	7.3
10	Lack of consistency between bill of quantities, drawings and specifications	211	6.8
9	Inaccurate quantities	195	6.3
11	Rush design	192	6.2

Figure (4.3) illustrates that greater part of contractors allocate design risks onto clients.

Contractors had considered that clients should bear the risks of:

- Defective design (84%)
- Not coordinated design (87%)
- Inaccurate quantities (48%)
- Lack of consistency between bill of quantities, drawings and specifications (58%)
- Rush design (68%)
- Awarding design to unqualified designers (81%)

Major allocation percents were heading towards clients who are in a better position to supply sufficient and accurate drawings on the design and services. These findings complied with results of (Ahmed et al., 1999) and (Kartam, 2001) who stated that the client could best manage deficiencies in specifications and drawings by appointing a capable consultant and providing sufficient design budget.

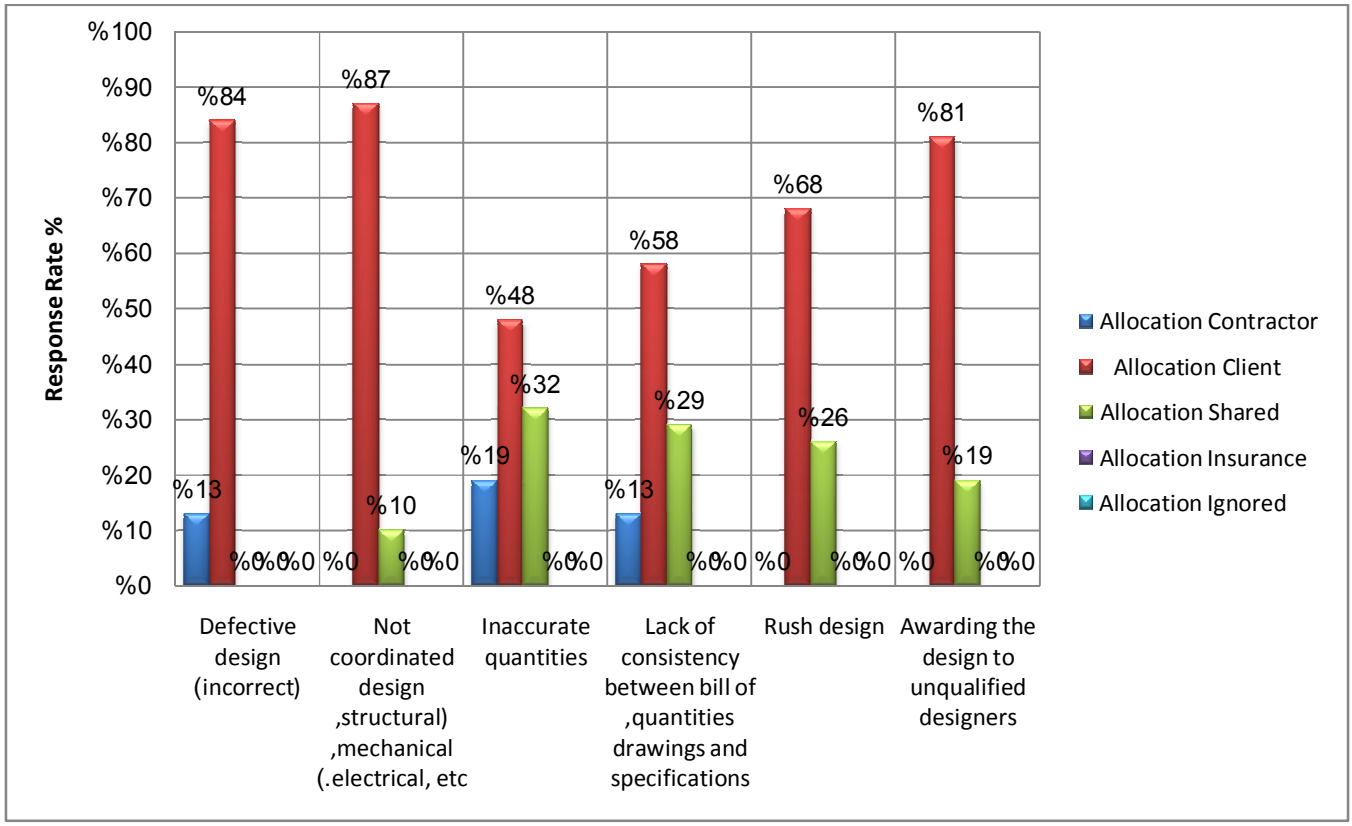

Figure 4.3. Design group factor allocation, contractor's perspective.

4.2.4 Logistics group (Group 4)

4.2.4.1 Severity

Table (4.4) shows the weights of logistic group factors. Contractors believed that the risks of unavailability of labor and materials and poor communication among contractor's teams are highly significant risks. It is obvious that the mentioned issues are serious risks that could be faced. The risk of contractors competence is a risk that contractors worried about, it is hard for contracting firms with high managerial costs to compete with firms with lower managerial costs. The unavailability of labor and materials is some how connected to political situations; if closure takes place, materials will be subject to increase in prices, reinforcement steel is a good example. Contractors worried about poor communications in their side; this reflects its occurrence, contractors should take care of this problem by working out and applying management standards to control such problems. Undefined scope of work and inaccurate project program approximately have the same severity, they have medium weights which pointed to the misunderstanding of these matters among contractors. These risks need to be fully comprehended. Such comprehension could ease and manage the work properly.

Table 4.4. Logistics group risks ranking

No.	Logistics Group Risks	Weight	Severity (1-10)
13	Unavailable labor, materials and equipment	222	7.2
17	Poor communications between the home and field offices (contractor side)	222	7.2
15	High competition in bids	201	6.5
14	Undefined scope of working	182	5.9
16	Inaccurate project program	179	5.8

4.2.4.2Allocation

Figure (4.4) indicates that contractors appear to be ready to accept the risks of:

- Unavailability of labor, materials and equipment
- Poor communication among contractor's teams

It is the contractor's duty to provide labor, materials and equipment to execute the work, in the same time, contracting firms should teach its teams how to communicate and exchange information. On the other hand, contractors were undecided on the allocation of other factors of the logistics group. It should be the liability of client who could manage the risk of contractor competence by enforcing rigorous criteria for the selection of contractor, this was supported by (Ahmed, et al 1999). Hence, risk of contractor competence should be allocated onto clients, but actually, current sluggish economic growth and highly competitive market in khartoum have forced contractors to reduce or even ignore their profit so as to remain competitive. With respect to other two factors, almost (50%) of contractors viewed them as shared risk. It is believed that clients should clearly define the scope of work and set up a proper program to abide by during construction, but this dose not eliminate the contractors responsibility even if was partial. Both contractor and client should be able to provide the staff and abilities to get a proper project program.

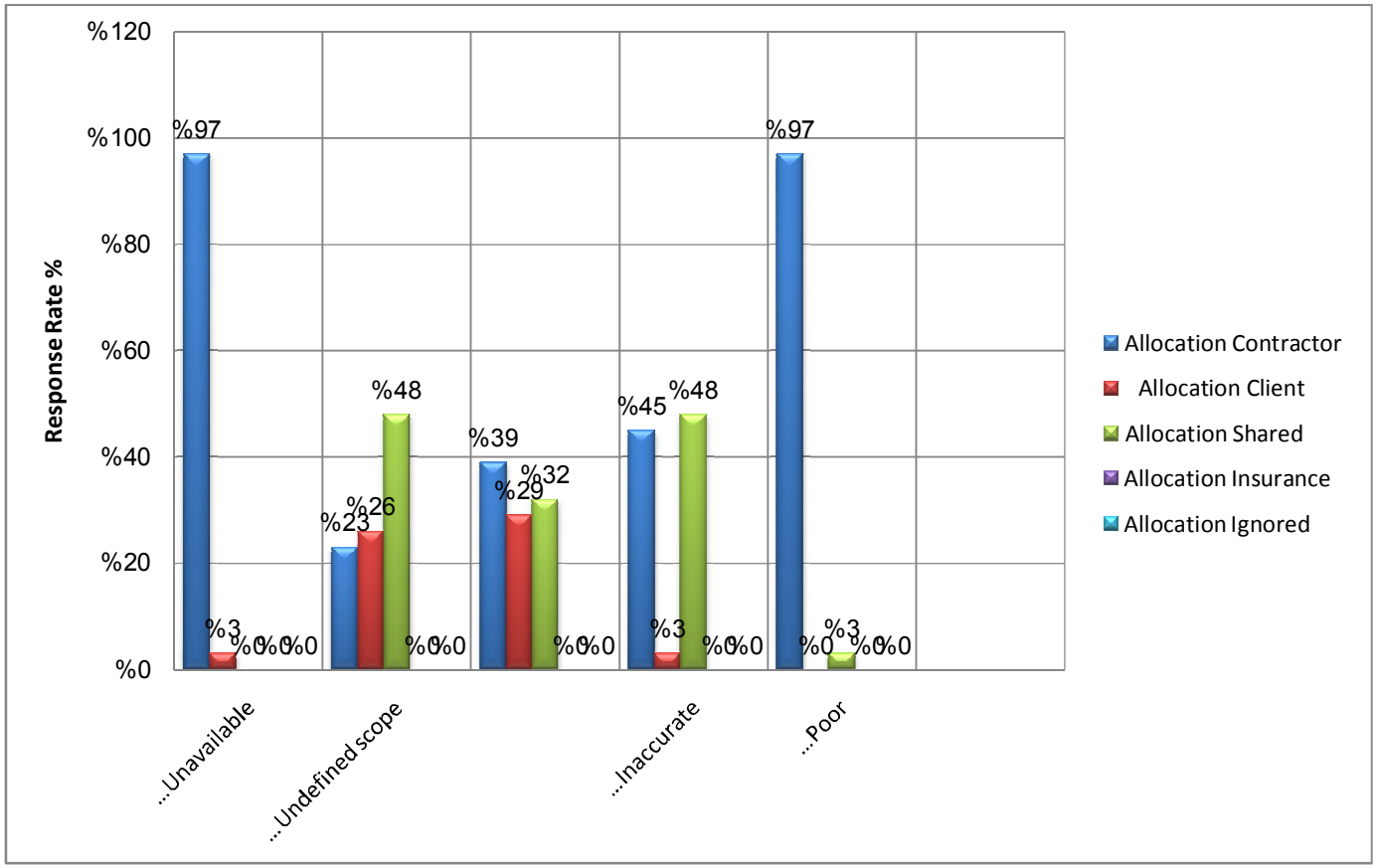

Figure 4.4. Logistics group risks allocation, contractors' perspective.

4.2.5 Financial group (Group 5)

4.2.5.1Severity

As seen in table (4.5), financial risks got the highest scores of surveyed risk factors given by contractor's respondents. Contractors considered the financial failure of contractor is the most sever risk in the financial group. According to Hallaq (2003), contractors could financially fail due to:

- Depending on banks and paying high.
- Lack of capital.
- Lack of experience in the line of work.
- Cash flow management.
- Low margin of profit due to competition.
- Lack of experience in contracts.
- Award contracts to lowest price.
- Closure.

More than 80% of the failures were caused by financial factors, that is why financial risks got the highest weights of the surveyed risks, Table (4.5). According to Argenti(Hallaq, 2003), small firms don't pay as much attention to financial ratios as do larger firms. Small firms have not an accounting department that publishes reports on a regular basis and therefore, financial ratios are difficult to monitor since they hire private accountants .Small firms never put into consideration the employee's benefits and compensations, variation orders, controlling equipment cost and usage, material wastages and yearly evaluating profits as a priority which may affect the financial situation of the company.

Table 4.5. Financial group risks ranking

No.	Financial Group Risks	Weight	Severity (1-10)
20	Financial failure of the contractor	279	9.0
19	Delayed payments on contract	260	8.4
21	Unmanaged cash flow	256	8.3
23	Monopolizing of materials due to closure and other unexpected political conditions	243	7.8
18	Inflation	240	7.7
22	Exchange rate fluctuation	232	7.5

4.2.5.2Allocation

Figure (4.5) shows that contractors appear to be ready to bear the risks of:

- Financial failure of contractor (71%)
- Unmanaged cash flow (90%)

Majority of contractors (81%) allocated the delayed payments risk to the owners. This risk category is one of the most debated ones. These results are supported by (Kartam, 2001). Moreover Kangari (c Kartam, 2001) stated that in the law, this item can be claimed as part of loss and expense (Kangari, Kartam, 2001). Contractor's respondents were undecided on who should take inflation risk, but (45%) of the contractor respondents considered it as a contractor's issue because the contracts here in Khartoum contain clauses to allocate such risks onto the contractors. Even, the pre-bid meeting minutes could contain such clauses. Contractors are considering this risk category as an oscillating risk category, where its threat increases when inflation increases, and vice versa. Contractors were undecided about exchange rate fluctuation and monopoly risks. Inflation and exchange rate fluctuation risks should be best shared between the client and the contractor by including contract clauses that define the required parameters and conditions for sharing. These are risks where each party

may be able to manage better under different conditions and could be specified in contracts as suggested above.

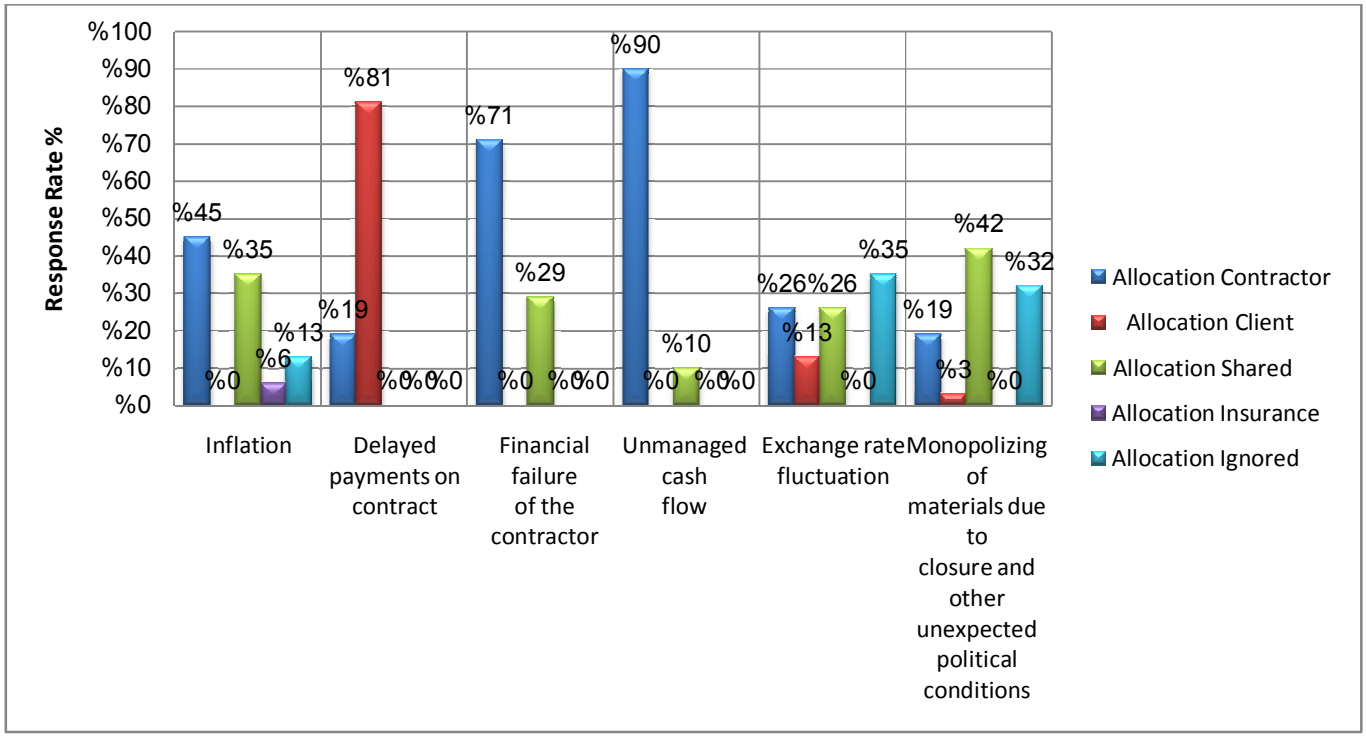

Figure 4.5. Financial group risks allocation, contractors' perspective

4.2.6Legal group (Group 6)

4.2.6.1Severity

Table (4.6) shows that legal disputes, delayed disputes resolution and lack of specialized arbitrators had the highest weights in the legal group, which indicates the importance of dispute resolutions and the disputes' consequences. Difficulty to settle disputes between project parties. Ambiguity of work legislations and difficulty to get permits came in the tail respectively. However the low weight indicates that contractors are not suffering of these risks, unlike Hong Kong contractors who do care about getting permits and consider it one of the most important risks (Ahmed et al, 1999).

Table 4.6. Legal group risks ranking

No.	Legal Group Risks	Weight	Severity (1-10)
26	Legal disputes during the construction phase among the parties of the contract	228	7.4
27	Delayed disputes resolutions	228	7.4
28	No specialized arbitrators to help settle fast	222	7.2
25	Ambiguity of work legislations	171	5.5
24	Difficulty to get permits	166	5.4

4.2.6.2Allocation

Figure (4.6) illustrates the allocation of legal group factors according to contractors respondents. It is obvious that the greatest part of contractor respondents deal with legal risks as shared risks. 48% of respondents considered the risk of difficulty to get permits a shared risk, on the other hand almost the third of respondents (29%) ignored this risk. 58% of respondents dealt with ambiguity of work legislations as shared too. The greatest part of respondents (94%) preferred to share legal disputes and delayed resolution with clients. Disputes could originate due to mistake or misunderstanding by either party. Hence, these risks should really be shared risks.

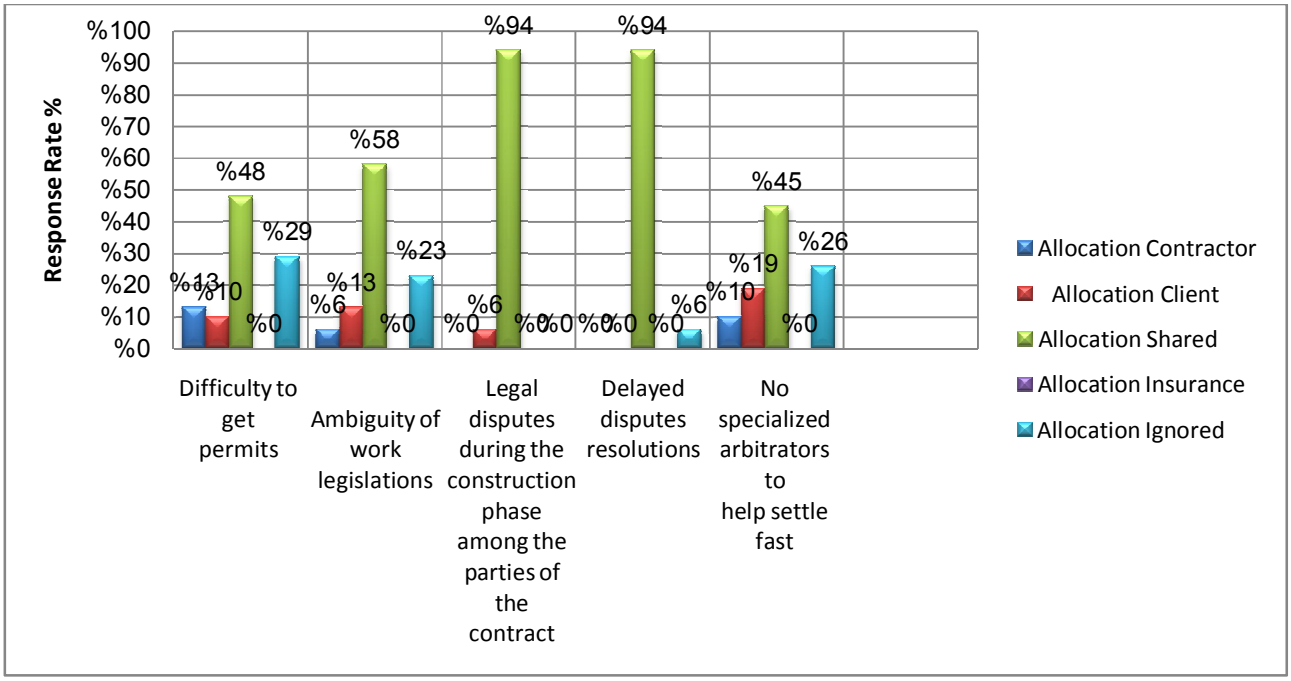

Figure 4.6. Legal group risks allocation, contractors' perspective