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Risk Management in Building Projects: Owners' Perspective

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Abstract: The construction industry is a key activity in any economy, it influences and is influenced by the gross domestic product of any country. The construction sector is one of the key economic sectors and is the main force motivating the Palestinian national economy. Construction is a risky industry with uncertainties due to many external and internal factors that influence the construction process. The aim of this paper is to identify the severity and allocation of each identified risk factor according to the owners' perspectives. A survey was conducted and forty four critical risk factors were identified and categorized into nine groups. The findings of this research showed that owners in the Gaza Strip have considered awarding the design to unqualified designer to be the most important risk factor followed by defective design and occurrence of accidents because of poor safety procedures. The results indicated that close supervision would be the effective mitigative method. It is recommended that tenders should be awarded to accurate estimated cost and not necessarily to the lowest bidder. This could take the edge of high competition in bids and reduce risks' consequences by providing more profit margins for contractors. Training programs should be arranged to advance managerial and financial practices to explain the internal and external risk factors affecting the construction industry and to initiate the proper ways to deal with such factors.

Keywords: Risk management, risk identification, risk allocation, risk mitigation, construction.

إدارة المخاطر في مشاريع البناء: وجهة نظر المالك

ملخـص: تسـاهم صناعة الإنشاءات بدور أساسي في اقتصاد الدول وكذلك في الاقتصاد الوطني الفلسـطيني . تعتـبر الإنشـاءات صناعة خطيرة وذلك لأسباب داخلية وخارجية تؤثر على عملية الإنشـاء . تهـدف هذه الدراسة الى التعرف على العناصر الخطرة ومدى خطورتها وكيفية تحملها وذلـك مـن وجهة نظر المالك . أظهرت نتائج هذه الدراسة إن ترسية تصميم مشاريع البناء على مصـممين غـير مؤهلين يعتبر من أهم المخاطر ويتبعها خطأ في التصميم وكذلك وجود الحوادث بسبب عدم وجود نظام للامان والسلامة في المشروعات.

Introduction :

The construction sector is one of the key economic sectors and is the main force motivating the Palestinian national economy. Upon the establishment of the Palestinian National Authority and the assumption of its powers over the Palestinian territories in 1994, the construction sector has witnessed noticeable expansion and activities. This has resulted in the recovery of the construction contracting profession and subsidiary

industries, encouraged the investment of the Palestinian expatriates' capital in the local construction sector, and contributed to the creation of jobs for thousands of Palestinians. Therefore, the construction sector has occupied the foremost position among the rest of sectors, mainly in the attraction of investments and creation of new jobs [1, 2].

The construction sector contributes 33% to the Palestinian GDP. This is a large proportion covered by this sector, thus positively affecting various economic, social, educational, and vocational sectors in addition to other Palestinian institutions. Construction industry is one of the most important sectors in the assimilation of labors force throughout Palestinian cities and towns. Currently, construction sector employs about 10.8% of laborers directly, and 30% indirectly in factories related to the construction sector and other service and productive sectors. Through a complementary process, several parties contribute to the construction sector. Such stakeholders are public and private sectors, universities and institutes, donor countries, international financing institutions and banking sector. Stakeholders make available necessary services, provide necessary materials, fund construction projects, and organize the construction contracting profession according to the laws and regulations enacted by governmental institutions [2, 3].

The management of risks is a central issue in the planning and management of any venture. Construction industry is subject to more risk and uncertainty than many other industries. The process of taking a project from initial investment appraisal to completion and into use is a complex process. Construction industry in Gaza Strip is suffering from the misunderstanding of risk management including risk identification, analysis and assessment, and that is why this research is important, where it will identify the risk factors in the construction industry in Gaza strip and determine the importance of each factor in terms of severity and allocation. The aim of this paper is to identify the severity and allocation of each identified risk factor according to the owners' perspectives.

Managing risks in construction

The construction industry has changed rapidly over the past ten years; companies are faced with more risk and uncertainty than before. Clients are more likely to engage in litigation when things go wrong. Risk in construction has been the object of attention because of time and cost overruns associated with construction projects. Risk can be defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective [4]. Jaffari [5] defined risk as the exposure to loss, gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Kartam [6] has defined risk as the probability of

occurrence of some uncertain, unpredictable and even undesirable events that would change prospects for the probability on a given investment.

There exist no comprehensive study explaining the cause of risks among construction companies; moreover research covering the subject matter has tended to identify the symptoms rather than causes. A number of authors have attempted in their studies to ascertain the causes of threats [7] and categorize the risks in the construction industry [8, 9, 10, 11]. A number of researches have examined the issue of risk management of construction projects. Bajaj et al [12] identified, investigated and evaluated the process of risk identification. Ramcharra [13] identified the risks usually faced by the construction firms in a foreign country. Kalayjian [14] identified the risks that are specific to the developing countries arguing that investors should bear the exchange and interest rate risks.

A number of variations of risk management process have been proposed. Raz and Michael [15] suggested a process consisting of two main phases: risk assessment, which includes identification, analysis and prioritization, and risk control which includes risk management planning, risk resolution and risk monitoring planning, tracking and corrective action. Tummala Burchett [16] identified risk management approach as a multiphase `risk analysis' which covers identification, evaluation, control and management of risks. Abbasi et al [17] provided a definition for the risk management as the sum of all proactive management-directed activities, within a program that is intended to acceptably accommodate the possibly failures in elements of the program. "Acceptably" is as judged by the customer in the final analysis, but from a firm's perspective a failure is anything accomplished in less than a professional manner and/or with less than-adequate result. Al-Bahar and Crandall [18] defined the risk management as a formal orderly process for systematically identifying, analyzing, and responding to risk events throughout the life of a project to obtain the optimum or acceptable degree of risk elimination or control.

PMI [19] suggested three ways of responding to risk in projects, they are as follows:

- Avoidance: eliminating a specific threat, usually by eliminating the cause. The project management team can never eliminate all risks, but specific risk events can often be eliminated.
- Mitigation: reducing the expected monetary value at risk events by reducing the probability of occurrence (e.g., using new technology), reducing the risk event value (e.g., buying insurance), or both.

- Acceptance: accepting the consequences. Acceptance can be active by developing a contingency plan to execute should the risk event occur or passive by accepting a lower profit if some activities overrun.

Akintoyne and Macleod [10], Enshassi and Mayer [11], Ahmed et al [20] and Education and Learning Whales [21] argued that there are four distinct ways of responding to risks in a construction project, namely, risk avoidance, risk reduction, risk retention and risk transfer.

According to the Project Management Body of Knowledge [19] risk management forms one of the so-called nine functions of project management (the other eight being integration, communications, human resources, time, cost, scope, quality and procurement management). The traditional view is that these functions should form the basis of planning and that each should be the focus of attention in each phase of the project. In the PMBOK, [19] presents four phases of the risk management process: identification, quantification, responses development and control. Risk Management covers the process of identification, assessment, allocation, and management of all project risks [22]. Abu Rizk [23] suggested a systematic process including risk identification, risk analysis and risk response, where risk response has been further divided into the four actions: risk retention, risk reduction, risk transfer and risk avoidance.

Risk management is also seen as a process that accompanies the project from its definition through its planning, execution and control phases up to its completion and closure [15]. Risk management is not synonymous with insurance, nor does it embrace the management of all risks to which a project is exposed. In practice, the truth lies somewhere between the two extremes. A risk management system must be practical, realistic and must be cost effective. The depth to which you analyze risk obviously depends upon your circumstance. Only you can judge the importance to be placed on a structured risk analysis. Conventional education does little to foster an awareness of how unpredictable reality can be [8]. Risk management measures the potential changes in value that will be experienced in a portfolio as a result of differences in the environment between now and some future point in time [24].

Methodology

This paper is based on a qualitative approach, which was selected to examine owners' observations and judgments in determining the relative significance of each identified risk factor. These risk factors were generated based on the knowledge obtained from literature review [4, 6, 10, 25, 26, 27] and consultation with key local experts. The response to each statement was divided into two groups: risk severity, and risk allocation. For risk

severity, the respondents were required to rank each risk on a scale from 1 to 10 by considering its contributions to project delays. Scale 1 to 10 was selected to obtain a greater level of suppleness in choosing statistical procedures [28]. Rank 1 is assigned to a risk that would give the lowest contributions to delays while rank 10 is allotted to a risk that would cause the highest contribution to delays. The rank range of 1 to 3 denotes risks that are not significant; 4 to 7 indicates significant risks, and 8 to 10 shows very high significant risks [6]. For risk allocation, the respondents must select the party actually taking the risk from one of the following five options: contractor, owner, shared (contractor and owner), insurance, and ignored.

In the survey, two kinds of management actions are presented to the respondents: preventive action and mitigative action [6, 27]. Preventive actions are used to avoid and reduce risks at early stages of construction project. Mitigative actions are remedial steps aimed at minimizing the effects of risks. The survey presents seven preventive and six mitigative actions. A draft questionnaire, with 36 risk factors categorized into seven groups (physical, environmental, design, logistics, financial, legal and management) was distributed to six key local experts in order to evaluate the content validity of the questionnaire, to check readability, offensiveness of the language and to add more factors and information if needed. As a result of this process, the experts suggested an addition of two more groups (political and construction) to suit the nature of the construction industry in the Gaza Strip.

Table 1. Risk factors included in the questionnaire

Physical (Group 1)	Occurrence of accidents because of poor safety procedures
	Supplies of defective materials
	Varied labor and equipment productivity
Environmental(Group 2)	Environmental factors (floods, earthquakes,…, etc.)
	Difficulty to access the site (very far, settlements)
	Adverse weather conditions
Design (Group 3)	Defective design (incorrect)
	Not coordinated design (structural, mechanical, electrical, etc.)
	Inaccurate quantities
	Lack of consistency between bill of quantities, drawings and specifications
	Rush design
	Awarding the design to unqualified designers
Logistics (Group 4)	Unavailable labor, materials and equipment
	Undefined scope of working
	High competition in bids
	Inaccurate project program
	Poor communications between the home and field offices (contractor side)
Financial (Group 5)	Inflation

	Delayed payments on contract
	Financial failure of the contractor
	Unmanaged cash flow
	Exchange rate fluctuation
	Monopolizing of materials due to closure and other unexpected political conditions
Legal (Group 6)	Difficulty to get permits
	Ambiguity of work legislations
	Legal disputes during the construction phase among the parties of the contract
	Delayed disputes resolutions
	No specialized arbitrators to help settle fast
Construction(Group 7)	Rush bidding
	Gaps between the Implementation and the specifications due to misunderstanding of drawings and specifications
	Undocumented change orders
	Lower work quality in presence of time constraints
	Design changes
	Actual quantities differ from the contract quantities
Political (Group 8)	Segmentation of Gaza Strip
	Working at hot (dangerous) areas (close to IDF positions)
	New governmental acts or legislations
	Unstable security circumstances (Invasions)
	Closure
Management (Group 9)	Ambiguous planning due to project complexity
	Resource management
	Changes in management ways
	Information unavailability (include uncertainty)
	Poor communication between involved parties

They also suggested to add 12 risk factors, and to omit four risk factors. Theses factors were amalgamated with the original risk factors and the required modifications have been introduced to the final draft of the questionnaire. A total of 44 factors were distributed into nine groups to form the final version is presented in Table 1. The questionnaire was sent out to a total of 80 public owners. Only a total of 45 completed questionnaires were returned representing a response rate of 56%.

Results and discussion

This paper described the current views of owners in the Gaza Strip concerning the severity and allocation of the 44 risk factors which have been categorized in nine groups (physical, environmental, design, logistics, financial, legal, construction, political, and management). The paper also investigated the various preventive and mitigative risk management actions which utilized in the local construction industry.

Risk severity and allocation

Physical group (Group 1)

Severity

Occurrence of accidents was ranked first by owner's respondents with (258) weight as shown in Table 2. This indicates that owners are concerned about safety measures in construction projects. Owners paid less attention to defect material supplies, and they were less concerned about variation in productivity; this result is supported by the results of [25] and those of [29] which considered the risks of defect materials and safety measures as very important risks.

Table 2: Physical group risks ranking

Physical Group Risk factors	Weight	Severity (1-10)
Occurrence of accidents because of poor safety procedures	258	8.1
Supplies of defective materials	201	6.3
Varied labor and equipment productivity	165	5.2

Allocation

Figure 1 shows that owner's respondents decided to allocate all the physical group risks to contractors. The majority of respondents allocate occurrence of accidents, defect material supplies and productivity variation to contractors by (72%), (69%) and (84%) of respondents respectively. These deductions comply with the results of [25] in Hong Kong. It is believed that the contractor is in a better position to control these issues.

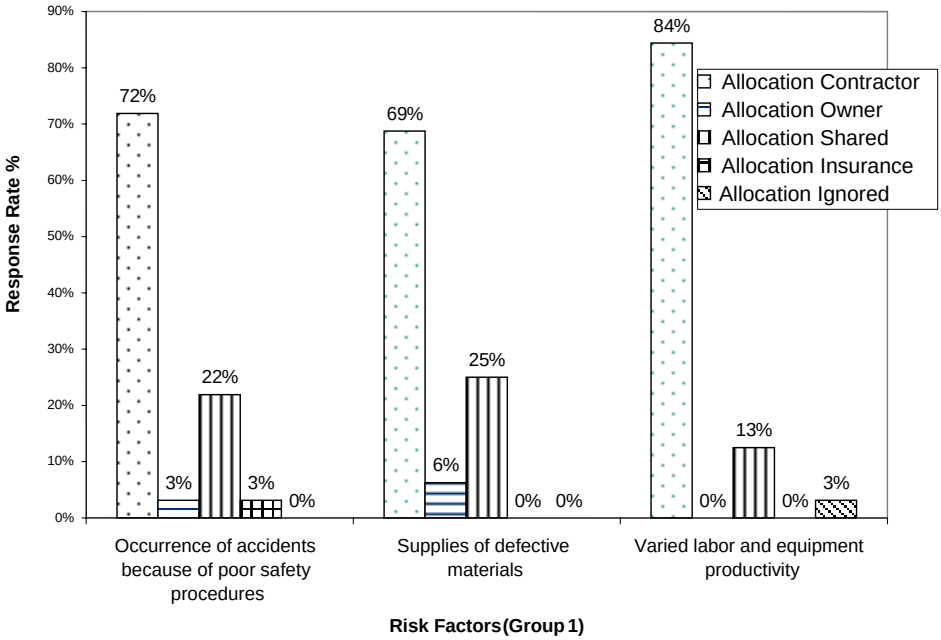

Figure 1: Physical group risks allocation, owners' perspective

Environmental group (Group 2)

Severity

As shown in Table 3, owner's respondents are concerned about site accessibility which was ranked first with (258) weight. The second was environmental factors risk with (178) weight and adverse weather conditions risk comes third with (165) weight. Owners have little concern about weather conditions, but they were worried about site accessibility.

Table 3: Environmental group risks ranking

Environmental Group Risk factors	Weight	Severity (1-10)
Difficulty to access the site (very far, settlements)	253	7.9
Environmental factors	178	5.6
Adverse weather conditions	165	5.2

Allocation

Figure 2 illustrates the allocation of environmental risks according to owners' perspective. The respondents nearly allocated the site accessibility risk as shared risk (59%). 34% of respondents considered this risk as contractor's issue, this share of respondents has a trend to allocate risks onto

contractor although these risks are out of control risks. Respondents were undecided about the risks of Environmental factors and adverse weather conditions, which is normal point of view as these risks are out of control. Contractors and owners should share such risks. Kartam [6] and Ahmed, et al. [25] are in line with these results.

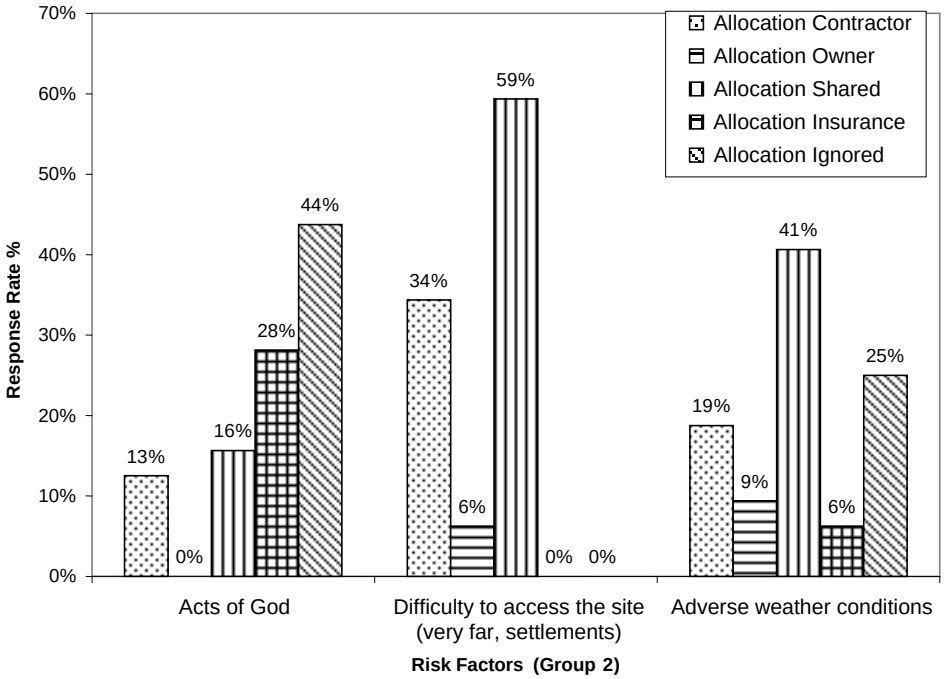

Figure 2 Environmental group risks allocations, owners' perspective

Design group (Group 3)

Severity

Table 4 demonstrates weights and severity of design group factors. As well as contractors, Owner's respondents considered design a high risks. Owners are concerned about the quality of design. It has to be noted that owners concerned about defective design issues because they could be the trigger for many disputes and undesirable consequences. This risk if not treated properly, it could lead to undesirable consequences in construction projects. These findings are strengthened by the results of [25, 30, 31]. The illegitimate result is to assign the risk of the rush design as a medium risk of the owners. It is a serious problem for owners to have this point of view.

Table 4 Design group risks ranking

Design Group Risk factors	Weight	Severity (1-10)
Awarding the design to unqualified designers	296	9.3
Defective design (incorrect)	260	8.1
Inaccurate quantities	246	7.7
Lack of consistency between bill of quantities, drawings and specifications	224	7.0
Rush design	211	6.6
Not coordinated design (structural, mechanical, electrical, etc.)	205	6.4

Allocation

Figure 3 allocates design risks from owners' perspective. It is clear that owners accepted to bear the risks of:

- Incorrect design
- Rush design
- Awarding to unqualified designers.

It could be observed from Figure 3that the risks of not coordinated design, inaccurate quantities, lack of consistency between quantities, specifications and drawings have received (59%), (34%) and (41%) responses respectively. They fell short of the chosen criterion (60% responses) for deciding its allocation. Hong Kong owners allocated the design risk on themselves [25]. This further justifies the need for innovative contract procurement methods such as management contracting which are more capable of allocating the risks to the parties that could best handle them.

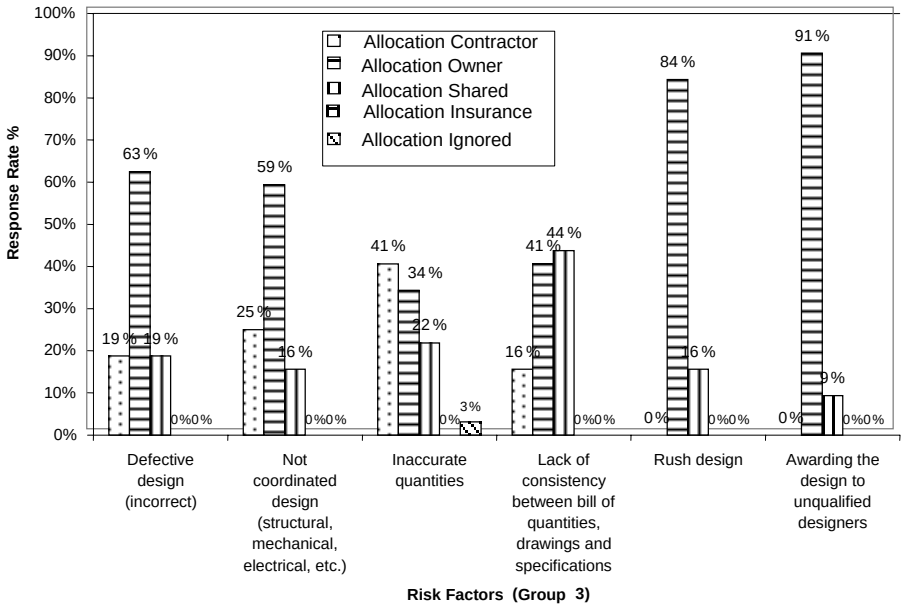

Figure 3 Design group risks allocation, owners' perspective

Logistics group (Group 4)

Severity

Table 5 illustrates the weights and severity of the logistics group risks. Owners are concerned about contractor competence and availability of labor and materials. For the first risk mentioned, it was argued the owners' policies are the direct causes of this risk. The weights given to this group factors are relatively high, this indicates the importance of these risks at owner's respondents. The respondents were concerned about poor communication of contractor's side, this risk makes obstacles in the way of accomplishment, and it can observed in large firms.

Table 5: Logistics group risks allocation

Logistics Group Risk factors	Weight	Severity (1-10)
High competition in bids	213	6.7
Unavailable labor, materials and equipment	211	6.6
Inaccurate project program	200	6.3
Poor communications between the home and field offices (contractor side)	187	5.8
Undefined scope of working	149	4.7

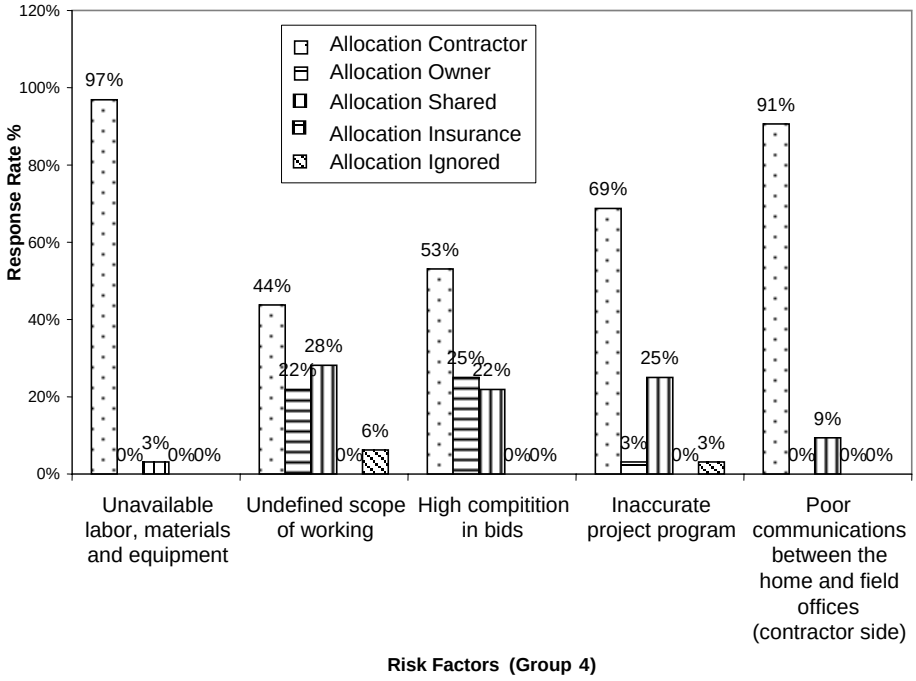

Figure 4 Logistics group risks allocation, owners' perspective

Allocation

As shown in Figure 4 owners had considered that contractors should bear the risks of:

- Labor and materials unavailability (97% response rate)
- Inaccurate project program (69% response rate)
- Poor communication between contractors' teams (91% response rate)

It should be the contractor's responsibility to make sure that labor and materials are available to execute the works. Unlike owners, it is believed that it should be a shared responsibility to put an accurate program to properly manage the projects tasks. Contractors should be able to control the communication process among their teams. Respondents were undecided about the risks of undefined scope of work and contractors competence. The risk of contractors' competence has to be the liability of the owner who could manage it by enforcing rigorous criteria for the selection of the contractor.

Financial group (Group 5)

Severity

Financial risks could be faced in construction projects are weighted and ranked in Table 6. Owner's respondents considered contractor's financial failure the most important financial risk with (215) weight. The next important is the risk of inflation (191), monopoly and unmanaged cash flow risks were the third and the fourth respectively with (176) and (171) weights, although unmanaged cash flow is a direct cause of contractor's financial failure in Gaza Strip. The fifth was the risk of delayed payments on contract. Owners worried about failure but they did not about delayed payments and exchange rate fluctuation. In other words, owners concerned about not stopping the works.

Table 6: Financial group risks ranking

Financial Group Risks	Weight	Severity (1-10)
Financial failure of the contractor	215	6.7
Inflation	191	6.0
Monopolizing of materials due to closure and other unexpected political conditions	176	5.5
Unmanaged cash flow	171	5.3
Delayed payments on contract	157	4.9
Exchange rate fluctuation	138	4.3

Allocation

As expected, the owners' respondents have allocated the financial failure and unmanaged cash flow to the contractors. Results of the survey show that owners accept to bear the risk of delayed payment with repose rate 81%. Owners considered that the contractor should be responsible about its failure and about managing its cash flow. Unfortunately, owners appeared not to share risks of inflation, exchange rate fluctuation or monopoly, while these risks should best be shared between owners and contractors by including contract clauses that define the required parameters and conditions for sharing. These are risks where each party may be able to manage it better under different circumstances and could be specified in the contract as suggested above (Figure 5).

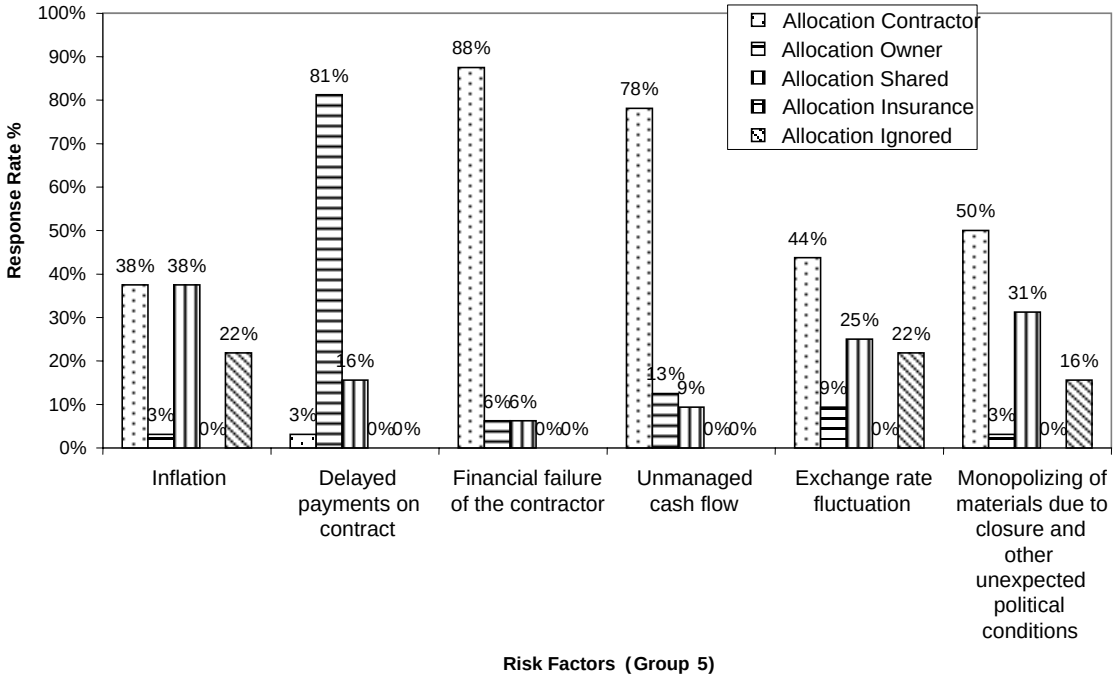

Figure 5: Financial group risks allocation, owners' perspective

Legal group (Group 6)

Severity

Table 7 Legal group risks ranking

Legal Group Risk factors	Weight	Severity (1-10)
Delayed disputes resolutions	205	6.4
No specialized arbitrators to help settle fast	192	6.0
Legal disputes during the construction phase among the parties of the contract	164	5.1
Ambiguity of work legislations	143	4.5
Difficulty to get permits	127	4.0

Results shown in Table 7 illustrate the weights and ranks of legal group risks. Respondents considered the risk of delayed dispute resolution one of the highest risks. Actually, owners have a less realistic view to the legal risks than contractors. Owners are less concerned about legal issues than contractors, which could raise more disputes and increase the delay in resolving these disputes. The owners in other places like Hong Kong and Kuwait pay more attention for legal issues [6, 25].

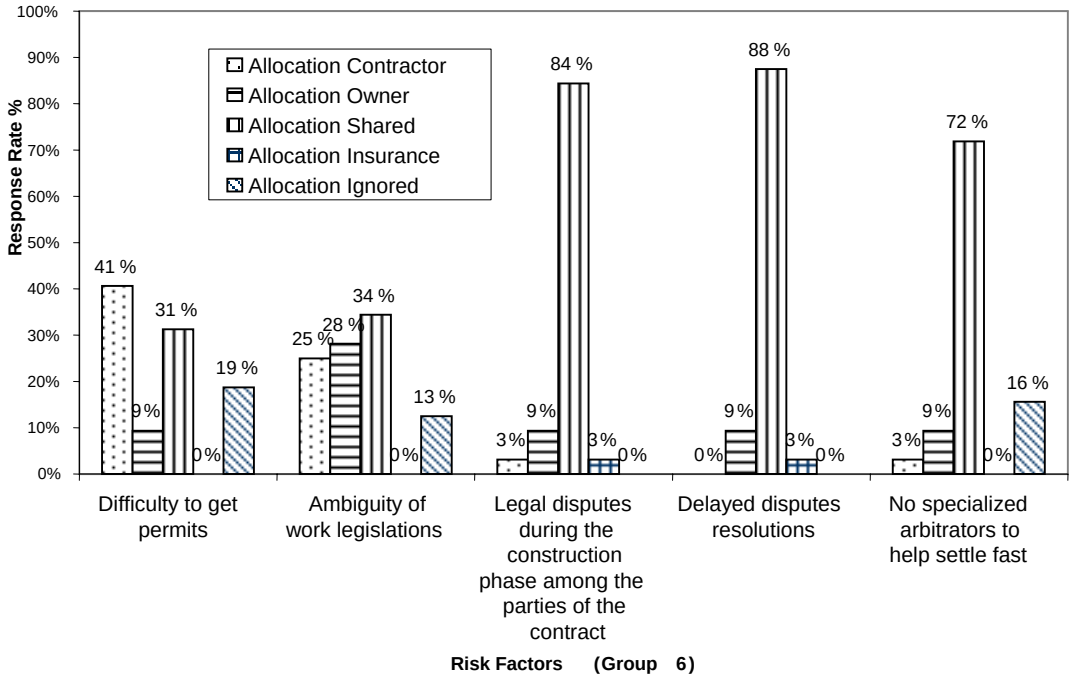

Figure 6 Legal group risks allocation, owners' perspective

Allocation

Owner's respondents were not decided about the risks of difficulty to get permits and the ambiguity of work legislation Figure 6. However, owners preferred to share the following risks with contractors:

- Legal disputes during construction phase (response rate 84%)
- Delayed disputes resolutions (response rate 88%)
- Arbitrators' absence (response rate 72%)

Construction group (Group 7)

Severity

As shown in table 8, the owner respondents did not give high weights to the factors mentioned in construction group. They considered rush bidding is more sever than other factors. Due to the local situation needs, several have had a very quick bidding process. This has put sever risks on both owners and contractors.

Table 8: Construction group risks ranking

Construction Group Risk factors	Weight	Severity (1-10)
Rush bidding	198	6.2
Lower work quality in presence of time constraints	186	5.8
Gaps between the Implementation and the specifications due to misunderstanding of drawings and specifications	178	5.6
Actual quantities differ from the contract quantities	166	5.2
Design changes	150	4.7
Undocumented change orders	140	4.4

Allocation

Results in Figure 7 show that owners allocate onto themselves the risks of :

- Rush bidding (75%)
- Design changes (66%)

It is the owners' responsibility to manage bidding process and to control design changes. They allocated onto the contractors the risk of low quality due to time constraints. Contractors have to pay all possible effort to accomplish the job according to specifications and standards even if time constraints exist. Respondents were uncertain of the risks of:

- Misunderstandings of drawings and specifications
- Undocumented change orders
- The differences between actual quantities and contract quantities.

The last mentioned risks should be really shared risks because they could occur due to misunderstanding by either party.

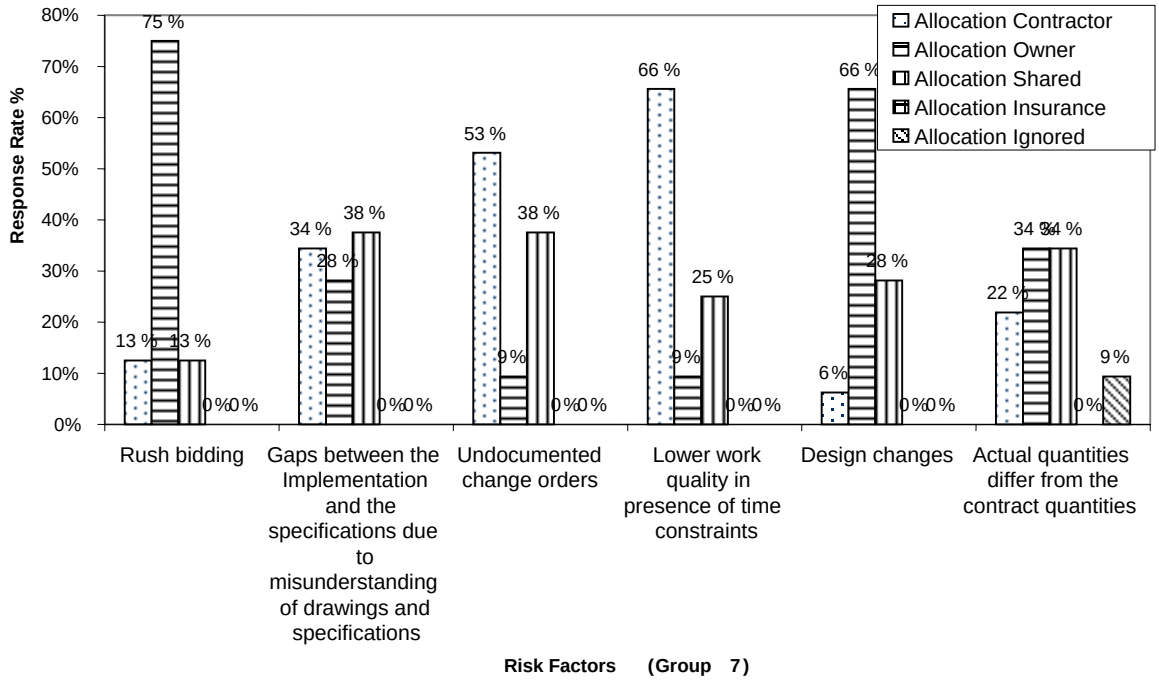

Figure 7: Construction group risks allocation, owners' perspective

Political group (Group 8)

Severity

Owners were worried about the political ingoing situation Table 9, respondents' apportioned high importance to the risks of working at dangerous areas and closure. New legislations and unstable sanctuary conditions risks were medium risks. On the contrary of contractors' views, owners considered the risk of segmentation of Gaza Strip is not an important risk. That is because the contractors need to move through Gaza Strip if he has several projects in several areas to be executed, but owners (Gaza Municipality for example) do not need a staff in Rafah.

Table 9: Political group risks ranking

Political Group Risk factors	Weight	Severity (1-10)
Working at hot (dangerous) areas (close to IDF positions)	224	7.0
Closure	214	6.7

New governmental acts or legislations	172	5.4
Unstable security circumstances (Invasions)	172	5.4
Segmentation of Gaza Strip	139	4.3

Allocation

Figure 8 shows that owners prefer to share the political risks with contractors. Political risks are out of control and should to be shared. Risks of political uncertainties should be equally applied to both parties of a contract. This is a risk where each party may be able to manage it better under different circumstances and could be specified in the contract by defining the conditions for sharing.

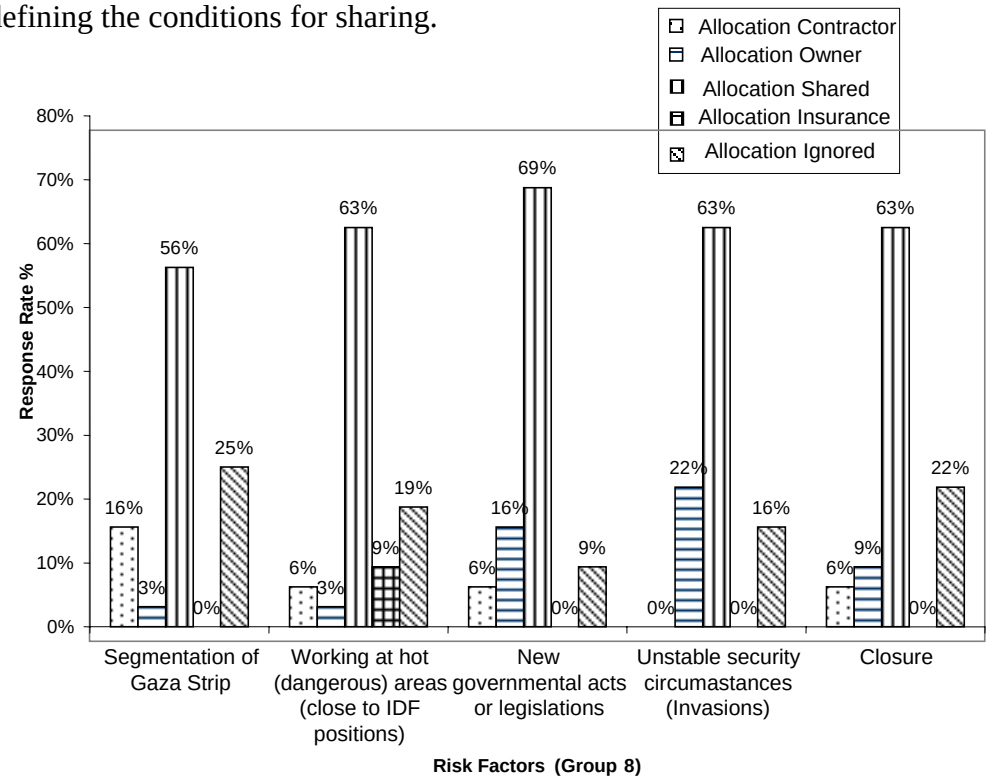

Figure 8: Political group risks allocation, owners' perspective

Management group (Group 9)

Severity

Table 10 illustrates the importance of management risks according to owner's respondents. Ambiguous planning and poor communication risks were the most important risks in management group with weights of (203) and (195) respectively. Other management risks are considered with

medium importance. Actually the management risks are considered contractor' issues, that explains the low importance given by owner respondents.

Table 10: Management group risks ranking

Management Group Risk factors	Weight	Severity (1-10)
Ambiguous planning due to project complexity	203	6.3
Poor communication between involved parties	195	6.1
Information unavailability (include uncertainty)	178	5.6
Resource management	156	4.9
Changes in management ways	151	4.7

Allocation

Owners allocated resource management and changes in management ways risks onto contactors Figure 9. Owners considered the poor communications risk should be shared with (81% responses). This consideration is sensible, since it is contractors' and owners' responsibility to maintain a good level of communication. They were uncertain about ambiguous planning and information unavailability risks. These risks also should be best shared. It is every party's favor to get a clear vision and proper planning for any project.

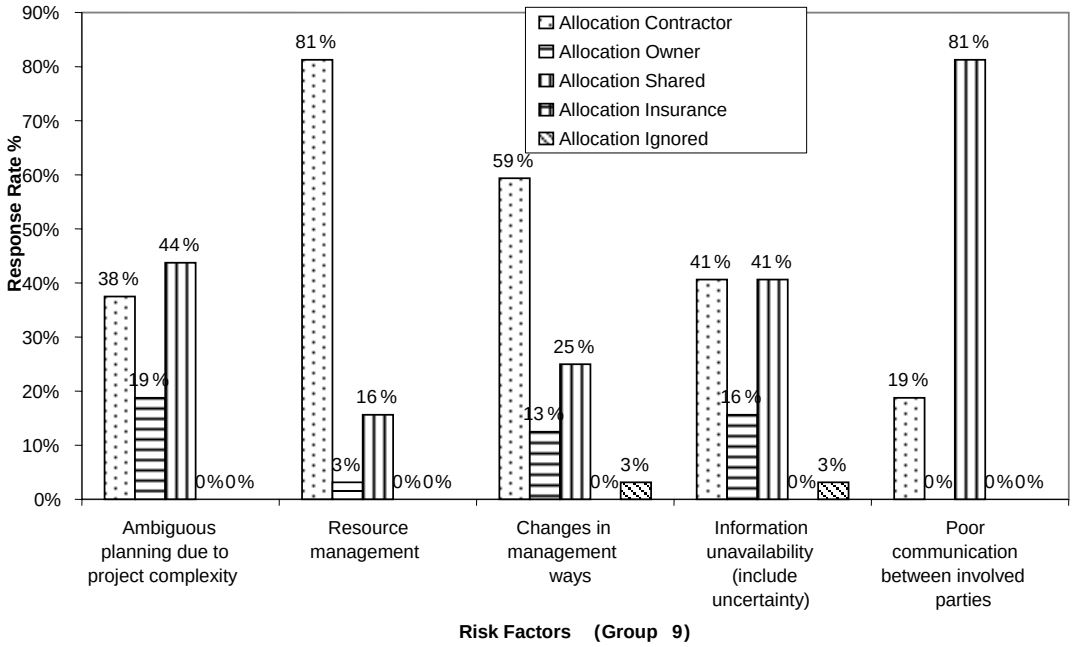

Figure 9: Management group risks allocation, owners' perspective

Overall risk significance and allocation, *owners' perspective*

Significance

Table 11 shows all risk factors included in the questionnaire ranked in descending order according to their weight from the owners' perspective. The most and least important risk categories for Gaza Strip owners are shown in Table 12 which was developed based on the data in Table 11. The result shows that Gaza Strip owners consider awarding the design to unqualified designer to be the most important construction risk giving it a score of (296). It was followed by defective design, with a score of (260). The scores of the five most important risks range between (246) and (296).The least important risk, from the owners' perspective is the risk of difficulty to get permits, with a score of (127) followed by the risk of exchange rate fluctuation with a score of (138). The results show that owners considered only (16%) of the risk factors as highly important risks and (84%) of them as medium risks.

Table 11: Risk factors ranking

No.	Risk Factors	Weight	Severity (1-10)
12	Awarding the design to unqualified designers	296	9.3
7	Defective design (incorrect)	260	8.1
1	Occurrence of accidents because of poor safety procedures	258	8.1
5	Difficulty to access the site (very far, settlements)	253	7.9
9	Inaccurate quantities	246	7.7
10	Lack of consistency between bill of quantities, drawings and specifications	224	7
36	Working at hot (dangerous) areas (close to IDF positions)	224	7
20	Financial failure of the contractor	215	6.7
39	Closure	214	6.7
15	High competition in bids	213	6.7
11	Rush design	211	6.6
13	Unavailable labor, materials and equipment	211	6.6
8	Not coordinated design (structural, mechanical, electrical, etc.)	205	6.4
27	Delayed disputes resolutions	205	6.4
40	Ambiguous planning due to project complexity	203	6.3
2	Supplies of defective materials	201	6.3
16	Inaccurate project program	200	6.3
29	Rush bidding	198	6.2
44	Poor communication between involved parties	195	6.1
28	No specialized arbitrators to help settle fast	192	6
18	Inflation	191	6
17	Poor communications between the home and field offices (contractor side)	187	5.8
32	Lower work quality in presence of time constraints	186	5.8
4	Environmental factors	178	5.6
30	Gaps between the Implementation and the specifications due to misunderstanding of drawings and specifications	178	5.6
43	Information unavailability (include uncertainty)	178	5.6
23	Monopolizing of materials due to closure and other unexpected political conditions	176	5.5
37	New governmental acts or legislations	172	5.4
38	Unstable security circumstances (Invasions)	172	5.4
21	Unmanaged cash flow	171	5.3
34	Actual quantities differ from the contract quantities	166	5.2
3	Varied labor and equipment productivity	165	5.2
6	Adverse weather conditions	165	5.2
26	Legal disputes during the construction phase among the	164	5.1

	parties of the contract		
19	Delayed payments on contract	157	4.9
41	Resource management	156	4.9
42	Changes in management ways	151	4.7
33	Design changes	150	4.7
14	Undefined scope of working	149	4.7
25	Ambiguity of work legislations	143	4.5
31	Undocumented change orders	140	4.4
35	Segmentation of Gaza Strip	139	4.3
22	Exchange rate fluctuation	138	4.3
24	Difficulty to get permits	127	4

Table 12: Most and least important risk categories as perceived by owners

Importance	**Risk**
High *(Most important ranked first)*	Awarding the design to unqualified designers
	Defective design (incorrect)
	Occurrence of accidents because of poor safety procedures
	Difficulty to access the site (very far, settlements)
	Inaccurate quantities
Low *(least important ranked first)*	Difficulty to get permits
	Exchange rate fluctuation
	Segmentation of Gaza Strip
	Undocumented change orders
	Ambiguity of work legislations

Allocation

Allocation of risk factors included in the questionnaire is appeared in Table 13, owners have allocated ten risks onto contractors, that means -from owners' perspective- contractors should be responsible for (23%) of the risk factors, they have allocated six risks onto themselves, i.e. owners accepted to bear only (14%) of the risk factors, and considered eight risks as shared risks, specifically, owners appeared ready to share (18%) of the risk factors with contractors. Finally, they were undecided about twenty risks. To be exact, owners were unsuccessful to allocate the greatest share (45%) of the risk factors on any party. These findings show the leakage of implemented contract systems regarding risk identification and allocation. Moreover, they could indicate the owners' desire to keep risk factors away of contractual issues.

Table 13: Risk allocation, Owners' perspective

Allocation	Risk Description
Contractor	Occurrence of accidents because of poor safety procedures
	Supplies of defective materials
	Varied labor and equipment productivity
	Unavailable labor, materials and equipment
	Inaccurate project program
	Poor communications between the home and field offices (contractor side)
	Financial failure of the contractor
	Unmanaged cash flow
	Lower work quality in presence of time constraints
	Resource management
Owner	Defective design (incorrect)
	Rush design
	Awarding the design to unqualified designers
	Delayed payments on contract
	Rush bidding
	Design changes
Shared	Legal disputes during the construction phase among the parties of the contract
	Delayed disputes resolutions
	No specialized arbitrators to help settle fast
	Working at hot (dangerous) areas (close to IDF positions)
	New governmental acts or legislations
	Unstable security circumstances (Invasions)
	Closure
	Poor communication between involved parties
Undecided	Environmental factors
	Difficulty to access the site (very far, settlements)
	Adverse weather conditions
	Not coordinated design (structural, mechanical, electrical, etc.)
	Inaccurate quantities
	Lack of consistency between bill of quantities, drawings and specifications
	Undefined scope of working
	High competition in bids
	Inflation
	Exchange rate fluctuation
	Monopolizing of materials due to closure and other unexpected political conditions
	Difficulty to get permits
	Ambiguity of work legislations

	Gaps between the Implementation and the specifications due to misunderstand
	Undocumented change orders
	Actual quantities differ from the contract quantities
	Segmentation of Gaza Strip
	Ambiguous planning due to project complexity
	Changes in management ways
	Information unavailability (include uncertainty)

Risk management actions

Preventive actions

Owners considered the subjective judgment is the most effective method used to produce a proper program Figure 10. Next, owners considered getting updated project information and use comparative estimates are effective preventive methods. Owners also decided not to consider utilization of quantitative risk analyses techniques and plan alternative methods as effective preventive methods for reducing the effects of risk. Insufficient knowledge and experience of analysis techniques and the difficulty of finding the probability distribution for risk in practice could be the main two reasons for such a result. Owners did not recommend sharing risks with other parties.

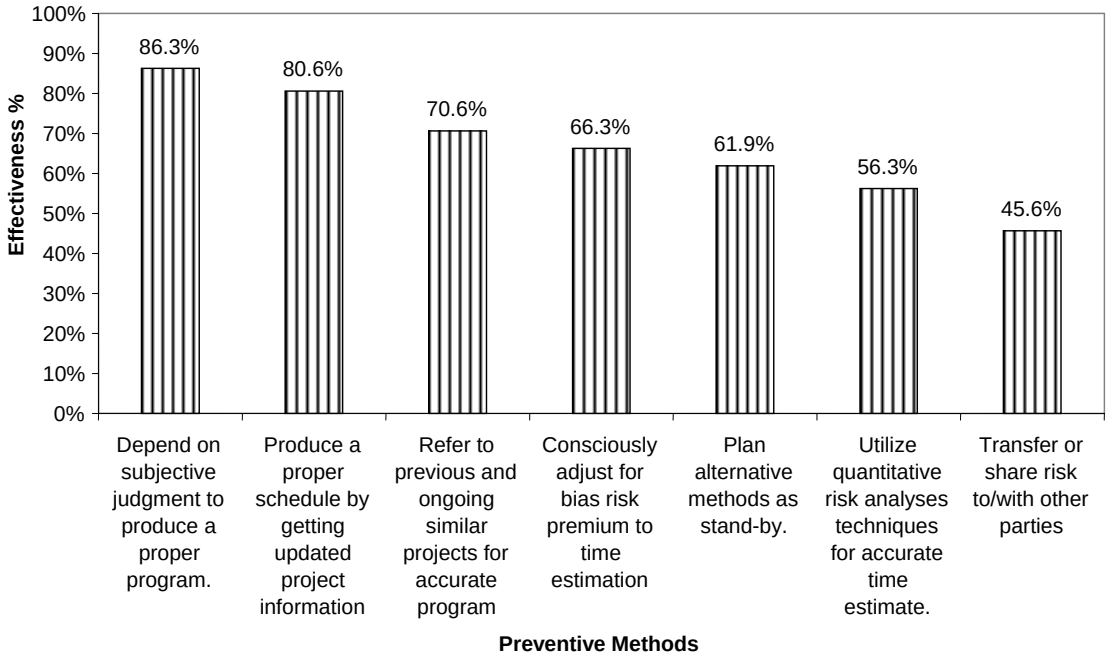

Figure 10: Preventive methods effectiveness

Mitigative actions

Figure 11 represents the six mitigative methods. The first mitigative method recommended by the respondents is close supervision to subordinates for minimizing abortive work and the last recommended mitigative method is change the construction method. Coordinate closely with subcontractors were the second most effective mitigative methods for minimizing the impacts of delay while change the construction method was rarely used as a mitigative method. Increase working hours and increase manpower and equipment were recommended by owners to be mitigative methods, which mean that owners believe that driving more effort could enhance the contractor's performance, since construction projects generally include many labor-intensive operations. In fact, as pointed out before, shortage of manpower in subcontractors' firms is one of the most serious risks to project delays. Therefore, increasing the work hours normally speeds up progress subject to the availability of materials and supervisors, physical constraints of the site, and construction sequence.

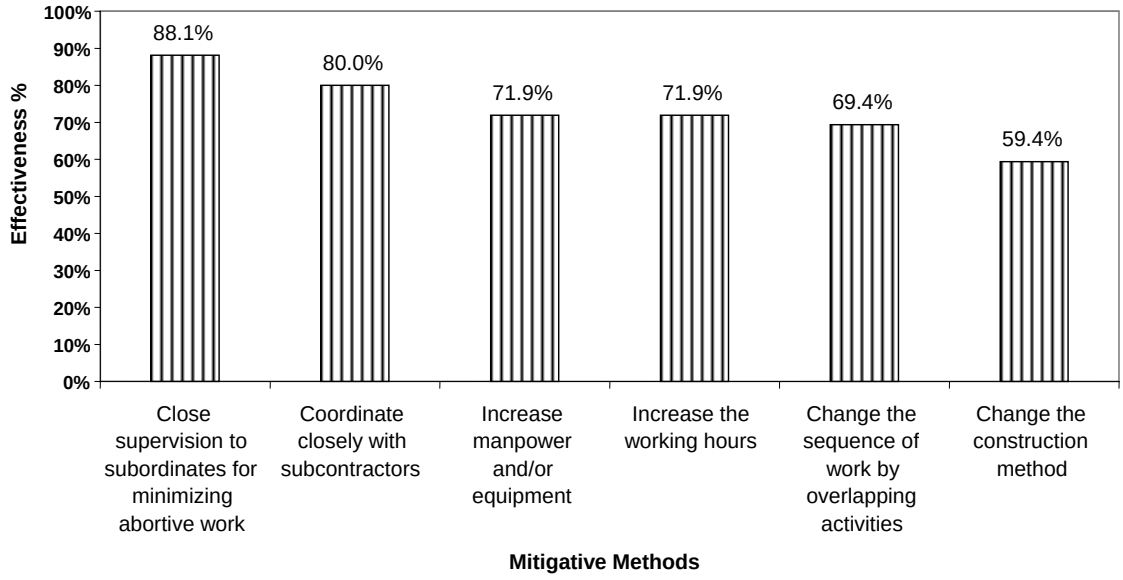

Figure 11: Mitigative methods effectiveness

Conclusion

Forty four critical risk factors were identified and categorized into nine groups: physical, environmental, design, logistics, financial, legal, management, political, and construction. The top ten sever risk factors according to the current views of owners are presented in Table 14.

Table 14: Most ten sever risk factors and allocation according to owners

Rank	Risk Description	Allocation
1	Awarding the design to unqualified designers	Owner
2	Defective design (incorrect)	Owner
3	Occurrence of accidents because of poor safety procedures	Contractor
4	Difficulty to access the site (very far, settlements)	Undecided
5	Inaccurate quantities	Undecided
6	Lack of consistency between bill of quantities, drawings and specifications	Undecided
7	Working at hot (dangerous) areas (close to IDF positions)	Shared
8	Financial failure of the contractor	Contractor
9	Closure	Shared
10	High competition in bids	Undecided

The allocation of these top ten critical risks were found to be: two construction risks were allocated to owner, two to contractor, and two shared. A total of four construction risks have undecided results. The findings also indicated that close supervision to subordinates for minimizing abortive work and coordinate closely with subcontractors are considered to be the most effective risk mitigative method utilized in the Palestinian construction industry. It is recommended that tenders should be awarded to accurate estimated cost and not necessarily to the lowest bidder. This could take the edge of high competition in bids and reduce risks' consequences by providing more profit margins for contractors. Exchange rate fluctuation should be considered as a risk factor by owners and donors and they should offer a compensation mechanism if there was any damage due to this risk. The contract clauses should be modified and improved to meet the impact of closure and segmentation of Gaza Strip and not to allocate the whole impacts on the contracting companies. Owners should conduct continuous training programs with cooperation with PCU to advance managerial and financial practices to explain the internal and external risk factors affecting the construction industry and to initiate the proper ways to deal with such factors. The design process is the most important phase in the construction process. Design products should be at the highest level of quality, because of that it should have more focus by owners.

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