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RISK MANAGEMENT IN BUILDING PROJECTS IN PALESTINE: CONTRACTORS' PERSPECTIVE

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ترتبط صناعة الإنشاءات بشكل كبير بدرجة عالية من الخطر و عدم الدقة وذلك بسبب طبيعة وبيئة العمل. ويهدف هذا البحث إلى التعرف على العوامل المختلفة للخطر وتقييمها كما تهدف الدراسة إلى كيفية تجنب وتقليل الأخطار ووسائل التعامل معها في مشاريع البناء في فلسطين، كما تبحث هذه الدراسة في كيفية توزيع وتحليل شدة الأخطار التي تم التعرف عليها من وجهة نظر المقاولين. لقد تم استخدام طريقة الاستبانة في هذه الدراسة وتم التعرف على 44 عنصر قد يشكل خطر على تنفيذ المشروع، وتم تقسيمها إلى 9 مجموعات. لقد بينت نتائج هذه الدراسة أن الفشل المالي للمقاول (الإفلاس) من أهم الأسباب التي تسبب خطر على المشروع، ويتبع ذلك العمل في مناطق خطرة وإغلاق المعابر الحدودية. كما أوضحت الدراسة أن الإشراف الدقيق يعتبر من أهم الطرق التي تعمل على تقليل الأخطار. توصي الدراسة شركات المقاولات بتحديد الأخطار التي تواجه المشاريع وتحديد تكلفتها. كما يجب على الجهات المالكة (الحكومة والمؤسسات الأخرى العاملة في قطاع الإنشاءات) إضافة قسط معين يضاف إلى سعر العطاء لتغطية الأخطار التي قد تطرأ على العمل. كما يجب تزويد المهندسين والمختصين العاملين في صناعة الانشاءات بدورات تدريبية متخصصة في كيفية التعامل مع الأخطار وتقليلها في مشاريع البناء.

The construction industry is widely associated with a high degree of risk and uncertainty due to the nature of its operating environment. This research study seeks to identify and evaluate key risk factors and their preventive and mitigating measures in building projects in Palestine. It also seeks to investigate the severity and allocation of each identified risk factor according to the contractors' perspective. A questionnaire survey was conducted and a total of forty-four critical risk factors were identified and categorized into nine groups. Research findings identify financial failure of the contractor to be the most important risk factor followed closely by two factors namely, working in dangerous areas and border closure. The results also indicate that close supervision is seen as the most effective risk mitigating method. The paper recommends that contracting companies should identify and adequately quantify project risk factors. Adding a risk premium to quotation and time estimation has to be supported by governmental owner organizations and other agencies in the local construction sector. Training courses should also be provided to construction professionals on how to deal with and minimize risks in building projects.

Keywords: Risk management, contractors, building projects, risk allocation

1. INTRODUCTION

Compared to other industries, the construction industry is at or near the top in the annual rate of business failures and resulting liabilities[1,2]. This is because it is a risky business with too many uncertainties that management has to deal with. These uncertainties stem from a variety of external and internal factors[3]. Forese [4] stated that the industry is characterized by having many players of multiple disciplines who are brought together at various stages throughout a single project. This feature adds more complexity to the whole construction process which is a collection of time-consuming undertakings.

There is no doubt that construction is a key activity in any economy, it influences, and is influenced by, the gross domestic product (GDP) of any nation[5]. The construction industry is a vital part of the U.S. economy. It provides jobs for about 8 million people creating a 12% slice of the American's gross domestic product[6]. In the U.K., the industry directly employs about 1.7 million people and accounts for about 6% of the national GDP[7]. Economically speaking, the building construction sector typically accounts for 35 to 40% of the construction market[1]. Building construction produces structures ranging from small retail stores to urban redevelopment complexes, from grade schools to complete new universities, hospitals, commercial office towers, theaters, government

buildings, recreation centers, light manufacturing plants and warehouses.

Construction is also a vital activity in the Palestinian economy. It contributes substantially in the Palestinian GDP and employment[8]. According to PCU[9], the local construction industry contributed 33% of value-added to the GDP. The building construction sector has played a crucial role in extending job opportunities for the Palestinian labor force. Expansion of construction activities has generated a lot of jobs for skilled, semi-skilled and unskilled workers. The number of domestic construction workers increased from 12.8 thousands in 1993 to 40.3 thousands in 2000. The share of this labor domestic employment has risen from 7.9% to 12% for the same period[10].

The management of risks is a central issue in the planning and management of any business venture. Unfortunately, the local construction industry seems to lack the ability to identify, analyze and assess risk associated with running the business, and that is why this research is important in the local context, as it aims to identify the risk factors in the local construction industry and determine the importance of each factor in terms of severity and perceived allocation. As such, the aim of this research is to identify and evaluate key risk factors and their preventive and mitigation measures as perceived by local contractors. It also investigates the severity and allocation of each identified risk factor from the contractors' perspectives.

2. RISK MANAGEMENT

Throughout the world, the construction industry has changed rapidly over the past decade; companies are now 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 subject of attention because of time and cost overruns associated with projects. As a result, risk can be defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project objective[11]. Jaffari[12] defined risk as the exposure to loss, gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Kartam[13] 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 causes 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 respective studies to ascertain the causes of threats[14] and categorize the risks in the construction industry[15-18]. A number of research studies have examined the issue of risk management of construction projects. Bajaj et al.[19] identified, investigated and evaluated the process of risk identification. Ramcharra[20] identified the risks usually faced by construction firms operating in a foreign country. Kalayjian[21] identified the risks that are specific to construction in developing countries arguing that investors should bear the exchange and interest rate risks.

A number of variations of the risk management process have been proposed. Raz and Michael[22], for example, 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 and Burchett[23] identified risk management approach as a multiphase `risk analysis' which covers identification, evaluation, control and management of risks. Simmons[24] 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[25] 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 [26] 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.

Ahmed et al[27] among other researchers[17,18,28] 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.

3. METHODOLOGY

This paper is based on a quantitative approach, which was selected to examine contractors' observations and judgments in determining the relative significance of each identified risk factor. Critical risk factors (statements) were generated as a result of undertaking a critical literature review[11,12,17,29-31] and consultation

Table 1. Risk factors included in the questionnaire

Physical (Group 1)	Occurrence of accidents because of poor safety procedures
	Supply 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)
	Un-coordinated design (structural, mechanical, electrical, etc.)
	Inaccurate quantities
	Lack of consistency between bill of quantities, drawings and specifications
	Rushed 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)	Rushed bidding process
	Gaps between the Implementation and the specifications due to misinterpretation 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

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 contribution to project delays. Scale 1 to 10 was selected to obtain a greater level of suppleness in choosing statistical procedures[32]. Rank 1 is assigned to a risk that would give the lowest contribution to delays whereas rank 10 is allotted to a risk that would cause the highest contribution. 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[13,36,37]. 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[12,31]. Preventive actions are used to avoid and reduce risks at the early stages of a project. Mitigative actions are remedial steps aimed at minimizing the negative 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. They also suggested to add 12 risk factors, and to omit four risk factors. These 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 presented in Table 1. The questionnaire was sent out to a total of 80 contractor companies. Only 45 completed questionnaires were returned representing a response rate of 56%.

4. RESULTS AND DISCUSSION

This section presents and describes the current views of contractors in the Gaza Strip concerning the severity and allocation of the identified 44 risk factors, and. It also investigates the various preventive and mitigative risk management actions currently utilized by the local industry.

4.1 Risk severity and risk allocation

4.1.1 Physical group (Group 1)

Severity

Results verified that the supply of defect materials is the most severe risk in the physical group (Table 2), followed by occurrence of accidents, and variations 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.[29] and the findings of [7] which considered the risks of defect materials and safety measures as very important risks.

Table 2. Physical group risks ranking

Physical Group Risks	Weight	Severity (1-10)
Supplies of defective materials	239	7.7
Occurrence of accidents because of poor safety procedures	221	7.1
Varied labor and equipment productivity	188	6.1

Allocation

The criterion for a risk to be appropriated to a particular category (owner, 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 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 the owners. That means that contractors are undecided about the allocation of safety risks. This is similar to the findings reported by Hong Kong contractors[29], but is dissimilar to those refelecting the practice in Kuwait where contractors are willing to bear safety risks[13]. In fact, contractors are better able to control such risks at construction sites. Moreover, the existence of insurance premiums for accidents and injuries can mitigate some of these 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 being supplied with defect materials and variation in productivity (71%). In fact, not only did contractors designate those factors as their responsibilities, but research also supports this position[29], Oglesby (cited in[12]).

4.1.2 Environmental group (Group 2)

Severity

As seen in Table 3, 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. This risk category increases the probability of uncertain, unpredictable and even undesirable impact on construction progress. However, the risks of adverse weather conditions and site accessibility did not appear with high significant risks among the surveyed risks. Environmental factors (catastrophes) which hardly occurs, has given rise to relatively low weight. These results are in line with the outcomes of Kartam's study[13].

Table 3. Environmental group risks ranking

Environmental Group Risks	Weight	Severity (1-10)
Difficulty to access the site (very far, settlements)	207	6.7
Adverse weather conditions	173	5.6
Environmental factors	160	5.2

Allocation

Figure 2 demonstrates that contractors are undecided on the allocation of risk of environmental factors. Moreover, about one third of the respondents (39%) seem to ignore this risk. On the other hand Smith and Gavin (cited in[29]) 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 owner and the contractor) by the majority of contractors (71%). As a matter of fact, this risk needs to be borne by the owner who should evaluate the needs during the planning phase, but due to the ongoing security-tense situation, contractors and owners have to coordinate their efforts to get a better handle 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 project owners in the Gaza Strip are legally protected from liability of this risk via assigning some explatory 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.

4.1.3 Design group (Group 3)

Severity

Design group factors included one of the most important surveyed risks. As illustrated in Table 4, 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 [13,33,34]. 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.

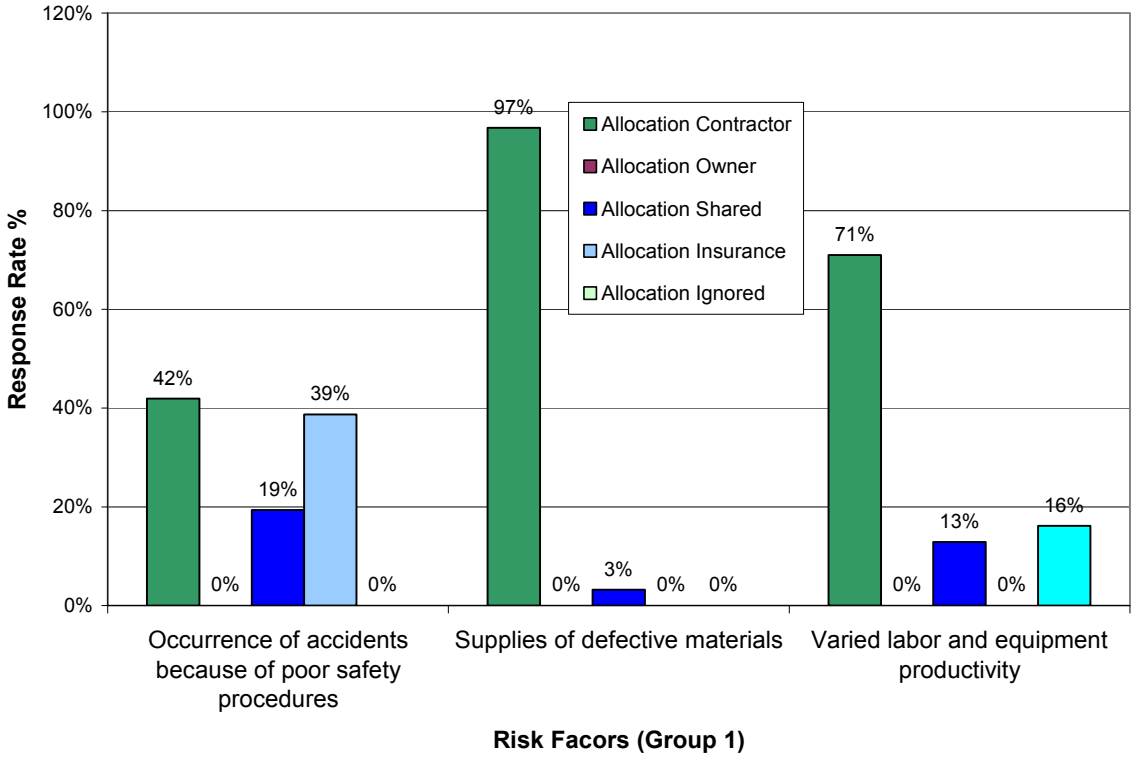

Figure 1. Physical group risks allocation, contractors' perspective

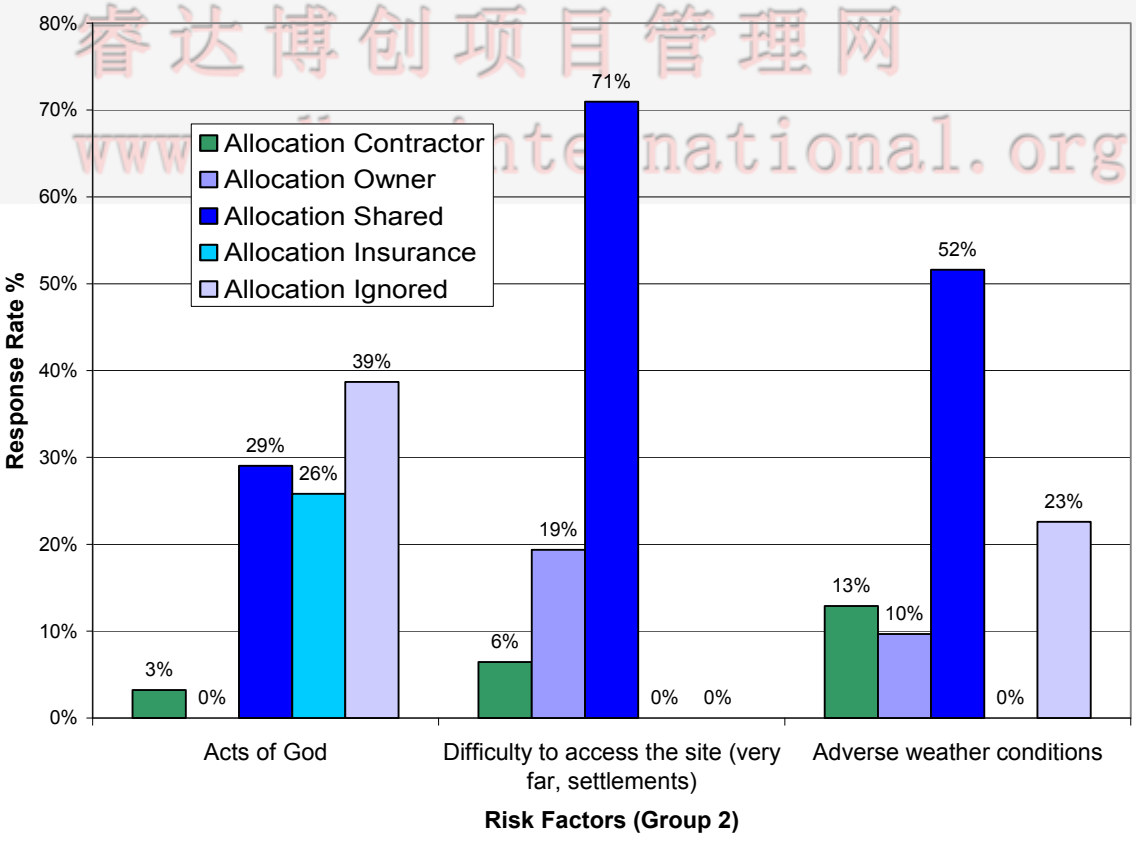

Figure 2. Environmental group risks allocation, contractors' perspective

Table 4. Design group risks ranking

Design Group Risks	Weight	Severity (1-10)
Defective design (incorrect)	264	8.5
Awarding the design to unqualified designers	243	7.8
Not coordinated design (structural, mechanical, electrical, etc.)	225	7.3
Lack of consistency between bill of quantities, drawings and specifications	211	6.8
Inaccurate quantities	195	6.3
Rushed design	192	6.2

Allocation

Figure 3 illustrates that majority of contractors allocate design risks to owners. Contractors had considered that owners should bear the risks of:

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

Major allocation was heading towards owners who are in a better position to supply sufficient and accurate drawings. These findings complied with results of [13,29] who stated that the owner could best manage deficiencies in specifications and drawings by appointing a capable consultant and providing sufficient design budget.

4.1.4 Logistics group (Group 4)

Severity

Table 5 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. The contractors' competition 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 somehow connected to political situations; if closure takes place, materials will be subject to increase in prices. 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 misinterpretation of these matters among contractors. These risks need to be fully comprehended. Such comprehension could ease and manage the work properly.

Table 5. Logistics group risks ranking

Logistics Group Risks	Weight	Severity (1-10)
Unavailable labor, materials and equipment	222	7.2
Poor communications between the home and field offices (contractor side)	222	7.2
High competition in bids	201	6.5
Undefined scope of working	182	5.9
Inaccurate project program	179	5.8

Allocation

Figure 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 owner who could manage the risk of contractor competence by enforcing rigorous criteria for the selection of contractor; this was supported by Ahmed et al.[29]. Hence, risk of contractor competence should be allocated onto owners, but actually, current sluggish economic growth and highly competitive market in Gaza Strip have forced contractors to reduce or even ignore their profit so as to remain competitive. With respect to inaccurate project program and undefined scope of work, almost (50%) of contractors viewed them as shared risk. It is believed that owners should clearly define the scope of work and set up a proper program to abide by during construction, but this does not eliminate the contractors responsibility even if was partial. Both contractor and owner should be able to provide the staff and abilities to get a proper project program.

4.1.5 Financial group (Group 5)

Severity

As shown in Table 6, financial risks got the highest scores of surveyed risk factors given by contractor's respondents. Contractors considered the financial failure of contractor as the most sever risk in the financial group. According to Enshassi[35], contractors could financially fail due to:

- Dependence on banks and paying high rates.
- 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.

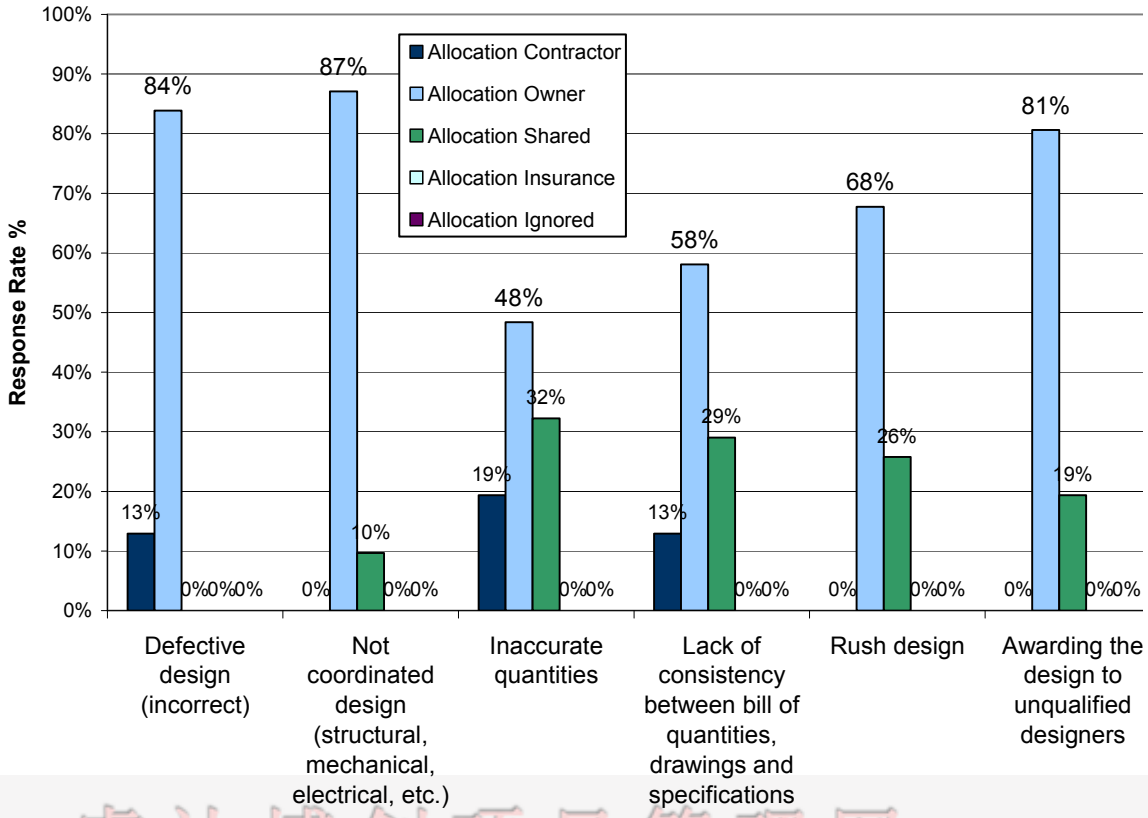

Figure 3. Design group factor allocations, contractor's perspective

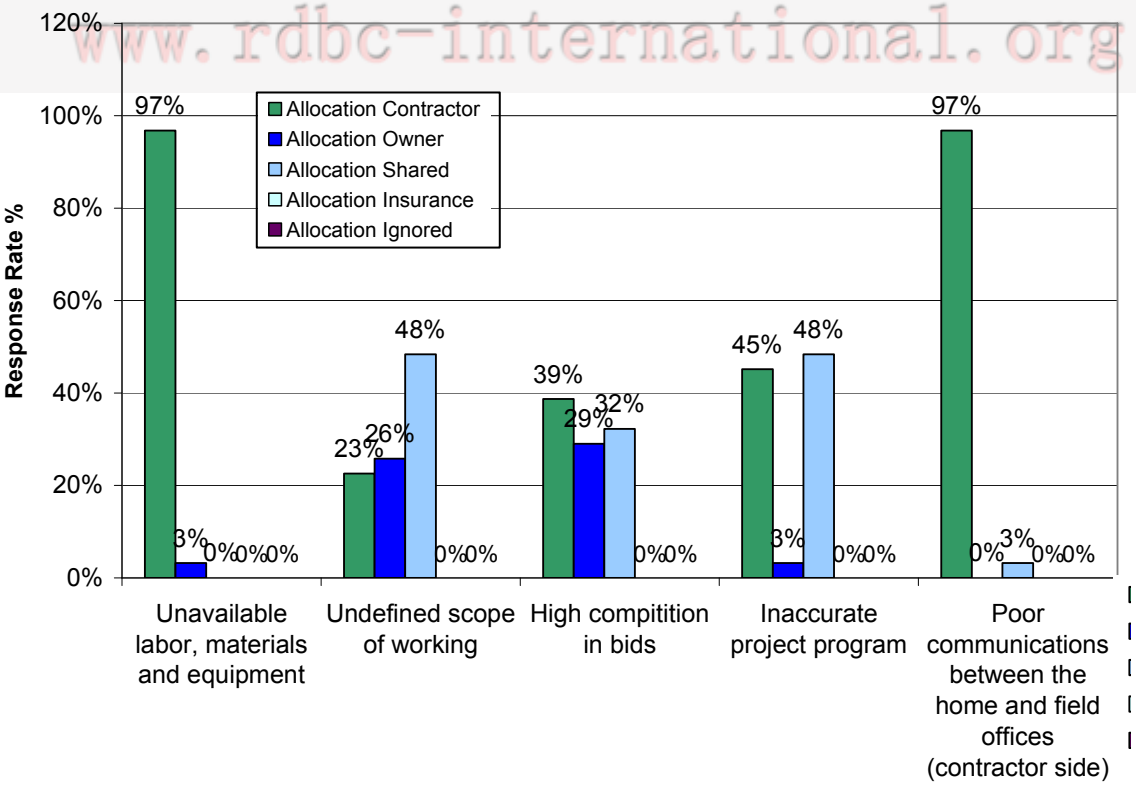

Figure 4. Logistics group risks allocation, contractors' perspective

More than 80% of the failures were caused by financial factors, that are why financial risks got the highest weights of the surveyed risks, Table 6. According to Argenti (cited in[35]), 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. Gaza strip 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 6. Financial group risks ranking

Financial Group Risks	Weight	Severity (1-10)
Financial failure of the contractor	279	9.0
Delayed payments on contract	260	8.4
Unmanaged cash flow	256	8.3
Monopolizing of materials due to closure and other unexpected political conditions	243	7.8
Inflation	240	7.7
Exchange rate fluctuation	232	7.5

Allocation

Figure 5 illustrates that contractors appear to be ready to bear the risks of:

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

The majority of contractors (response rate 81%) allocated the delayed payments risk to the owners. This risk category is one of the most debated ones. These results are supported[13]. Moreover Kangari (cited in[12]) stated that in the law, this item can be claimed as part of loss and expense.

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 Gaza Strip contain clauses to allocate such risks onto the contractors. Contractors consider this risk 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 owner 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.

4.1.6 Legal group (Group 6)

Severity

Table 7 shows that legal disputes, delayed dispute resolution and lack of specialized arbitrators had the highest weights in the legal group, which indicates the importance of dispute resolution and its consequences. These were followed by two risk factors namely ambiguity of work legislations and difficulty to get permits. However the low weight indicates that contractors are not too concerned with these two particular risks, unlike Hong Kong contractors who consider them important risks[29].

Table 7. Legal group risks ranking

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

Allocation

Figure 6 illustrates the allocation of legal group factors according to contractors' response. It is obvious that the majority of contractor respondents' deal with legal risks as shared risks. About 48% of respondents considered the risk of difficulty to get permit a shared risk, whereas almost one third of respondents (29%) ignored this risk completely. Also, 58% of respondents perceived ambiguity of work legislations as a risk to be shared. Interestingly, the majority of respondents (94%) preferred to share legal disputes and delayed resolution with owners. Given that disputes could originate due to decisions made by either party, it was encouraging to see contractors perceive it as shared risks.

4.1.7 Construction group (Group 7)

Severity

In Table 8 risks associated with construction were divided into two groups according to weights. The high importance group contained the risks of undocumented change orders, lower work quality and misinterpretation drawings and specifications respectively. Reported work[29]supports theses results. Considering the risk of undocumented change orders as a high importance risk reflects a trend in which contractors are concerned with obtaining payment for a work change, since the cost impact of cannot be claimed later. Contractors disturbed with the lower work quality, which means that contractors do their best not to have an abortive works, to maintain a good reputation and to avoid more costs repeating the abortive works. Other important risk is the risk of misinterpretation of drawings and specifications, this risk can cause significant work delays, which are why

Table 8. Construction group risks ranking

Construction Group Risks	Weight	Severity (1-10)
Undocumented change orders	236	7.6
Lower work quality in presence of time constraints	228	7.4
Gaps between the Implementation and the specifications due to misinterpretation of drawings and specifications	225	7.3
Design changes	187	6.0
Actual quantities differ from the contract quantities	169	5.5
Rushed bidding process	152	4.9

Table 9. Political group risks ranking

Political Group Risks	Weight	Severity (1-10)
Working at hot (dangerous) areas (close to IDF positions)	279	9.0
Closure	277	8.9
Segmentation of Gaza Strip	258	8.3
Unstable security circumstances (Invasions)	258	8.3
New governmental acts or legislations	151	4.9

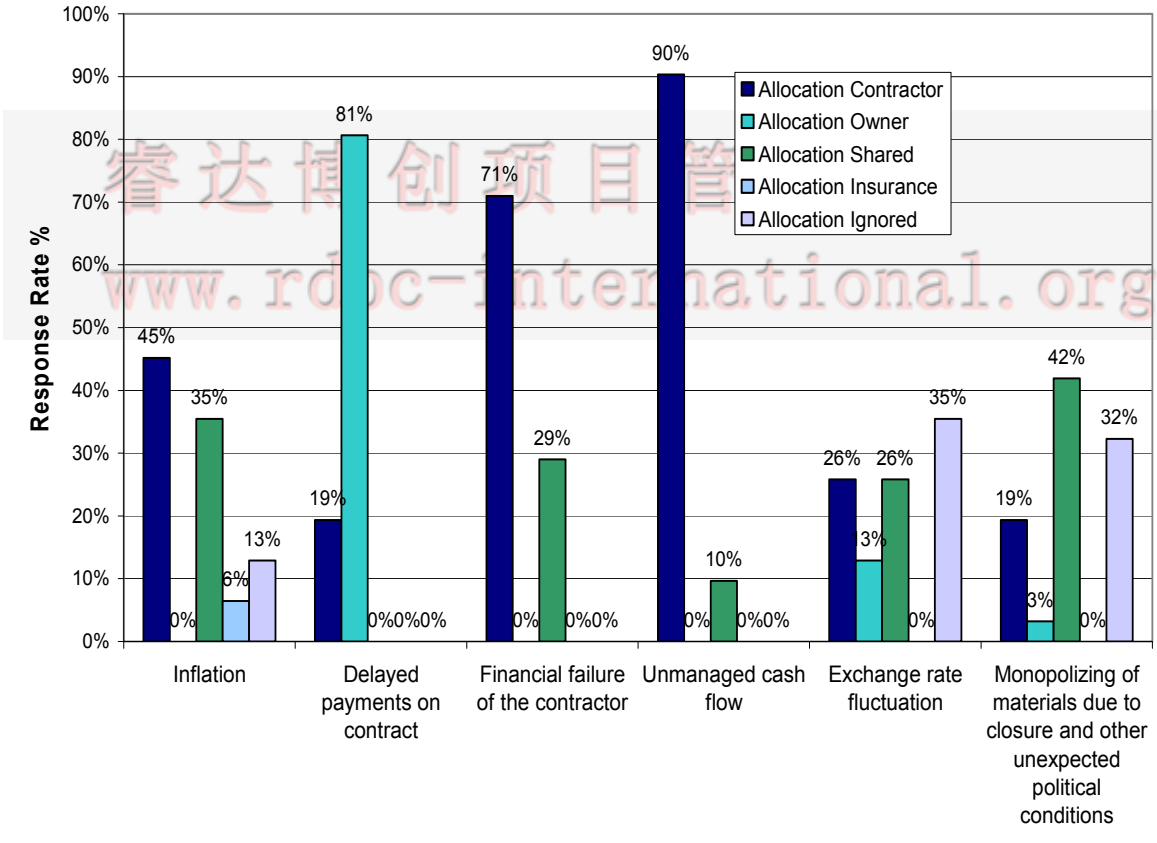

Figure 5. Financial group risks allocation, contractors' perspective

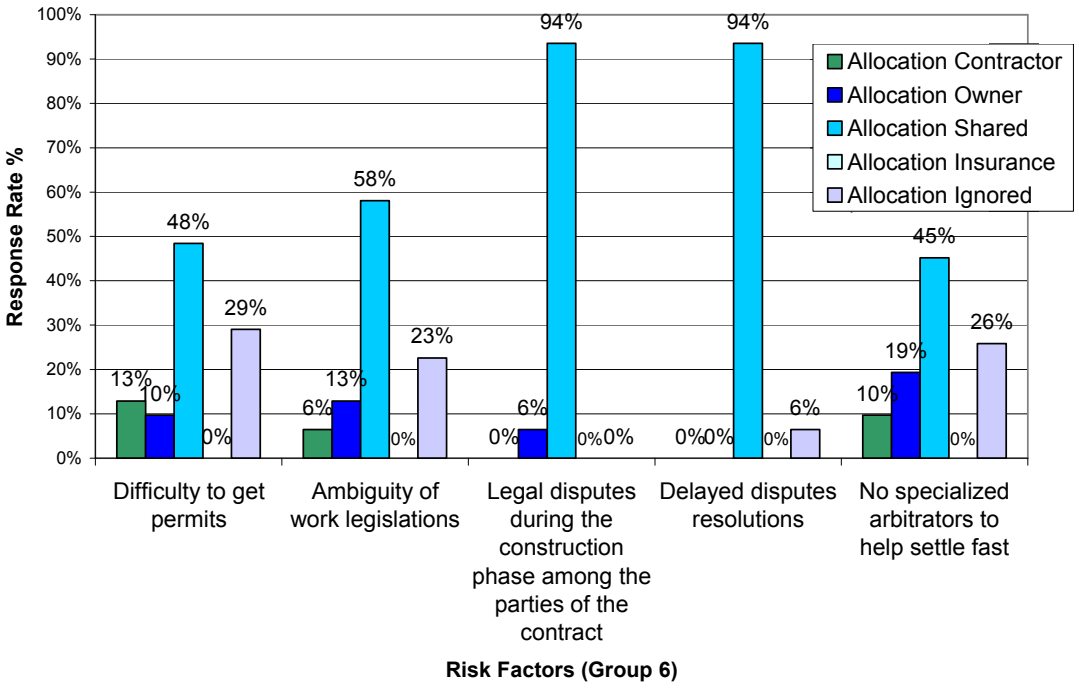

Figure 6. Legal group risks allocation, contractors' perspective

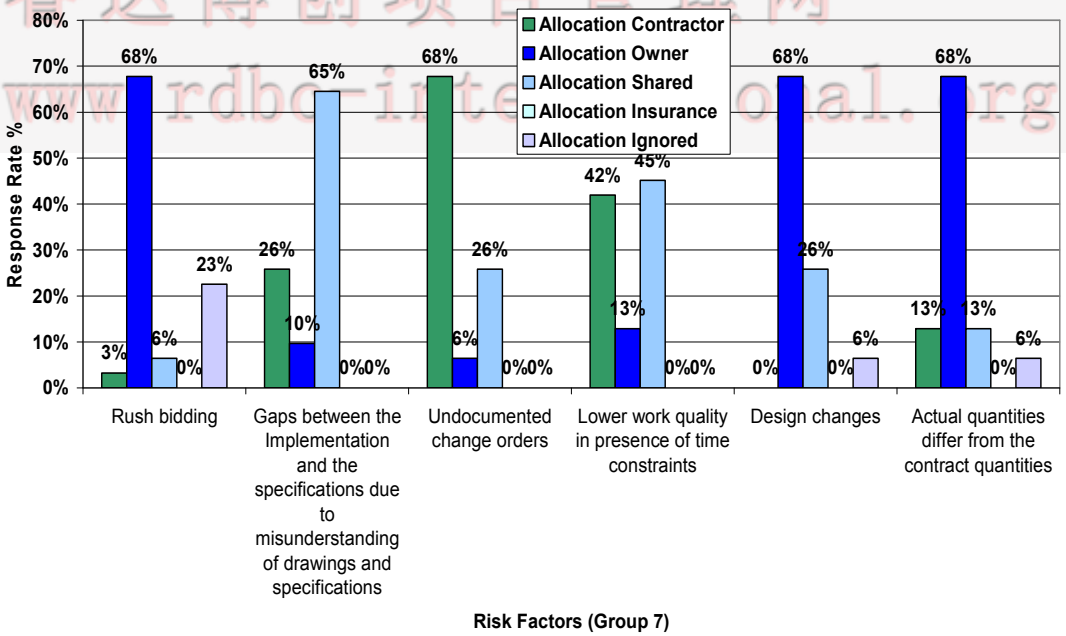

Figure 7. Construction group risks allocation, contractors' perspective

contractors exhibit awareness towards this risk. Design changes, difference between actual and contract quantities and a rushed bidding process were in the 4th, 5th and 6th places with medium severities, this reflects the little attention paid by contractors to these issues.

Allocation

Figure 7 shows the allocation of construction risks. Contractors accepted the risk of undocumented change orders (68%); contractors understand that the documentation of change order is their job. Majority of contractor respondents (68%) allocate the risks of rush bidding, design changes and difference between actual and contract quantities on the owner. Allocating design changes risk category to the owner reflects a trend in which contractors are not very much concerned with changes in the work. Respondents were undecided about lower quality of work in presence of time constraints. It is thought that this risk category should be allocated to the contractor, since contractors are in a better position to control this risk[13].

4.1.8 Political group (Group 8)

Severity

Table 9 demonstrates the ranking of political group risks. Almost all the political risks are considered very significant risks that are due to the unstable ongoing tense situation. However, respondents appeared that they do not care about new acts or legislations. The reason is that these acts have limited effects on construction issues. Recently, the unstable political events in the Gaza Strip reflect the greatest unpredictable cost overburden that a contractor could face. Working at dangerous areas is considered a very high risk; contractors cannot be forced to work at such areas. Closure could cause unavailability of materials as well as inflation due to monopoly.

Allocation

In Figure 8, allocation of political risks is presented. Clearly, the respondents are willing to share most of risks with owners. Segmentation, working at risky areas, closure and unstable security circumstances were considered shared risks with (response rate 71%), (68%), (68%) and (61%) respectively. It is thought that all risks that cannot be controlled should be shared. About 55% of the respondents decided to share the new legislations risk–in spite of its low importance-with the owner whereas 35% of respondents opted to ignore it. This indicates the relatively low effects of such category.

4.1.9 Management group (Group 9)

Severity

Management group factors ranks are listed in Table 10. Poor communication between parties ranked first with (8.3) severity, the second was resource management with (7.3) severity, project complexity with (6.9) severity was third and the fourth was changes in management ways with severity of (6.4). These figures indicate both the importance of management topics for contractors and the existence of this type of risk, which need high-level management skills. Uncertainty ranked fifth with (6.2) severity.

Table 10. Management group risks ranking

Management Group Risks	Weight	Severity (1-10)
Poor communication between involved parties	258	8.3
Resource management	226	7.3
Ambiguous planning due to project complexity	215	6.9
Changes in management ways	199	6.4
Information unavailability (include uncertainty)	191	6.2

Allocation

Figure 9 illustrates the respondents' allocation of management risks. Contractors seemed to be ready to accept the resource management and change in management ways risks with (68%) and (61%) respectively. It is predictable for contractor to deal with these risks. Contractor respondents decided to share ambiguous planning, uncertainty and poor communication risks with (61%), (65%) and (71%) respectively. These three issues should be considered as shared risks; it is the contractor's and owner's duty to put a clear plan for the project execution, to clarify any ambiguous information and to maintain good communication manners in favor of project accomplishment.

4.2 Overall risk significance and allocation, contractors' perspective

Significance

Table 11 shows all risk factors included in the questionnaire ranked in a descending order according to their weight from the contractors' perspective. The most and least important risk categories are shown in Table 12 which was developed based on the data listed in Table 11. The result shows that contractors consider financial failure and working at hot (dangerous) areas to be the most important construction risks giving them a score of (279), as shown in Table 12. They were followed by Closure, with a score of (277). The scores of the five most important risks range between (260) and (279). The least important risk, from the contractors' perspective is the risk of new governmental acts, with a score of (151) followed by the risk of rushed bidding process with a score of (152). The scores range between (155) and (169). The results show that contractors considered (57%) of the risk factors as highly important risks and (43%) of them as medium risks.

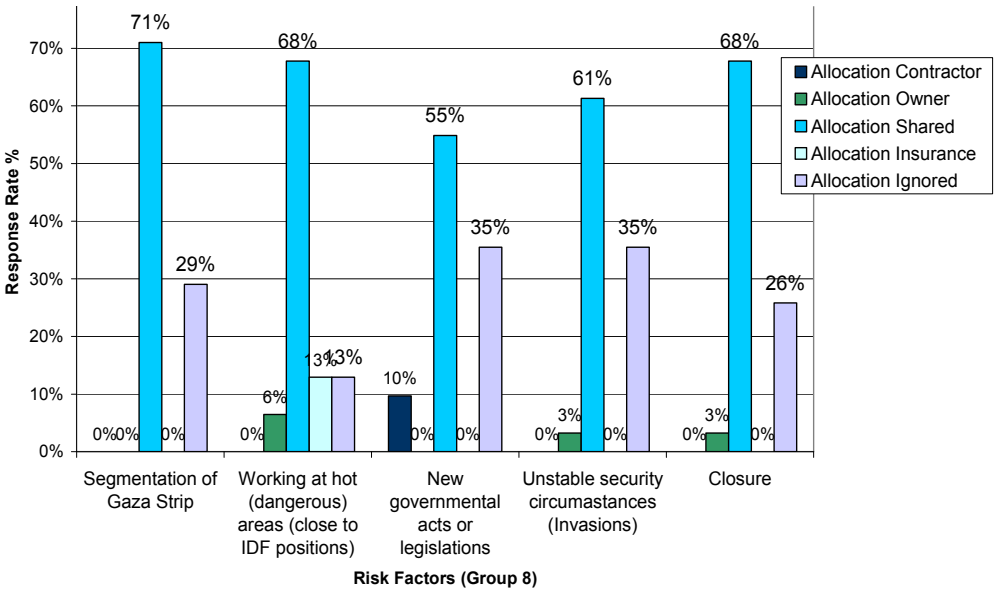

Figure 8. Political group risks allocation, contractors' perspective

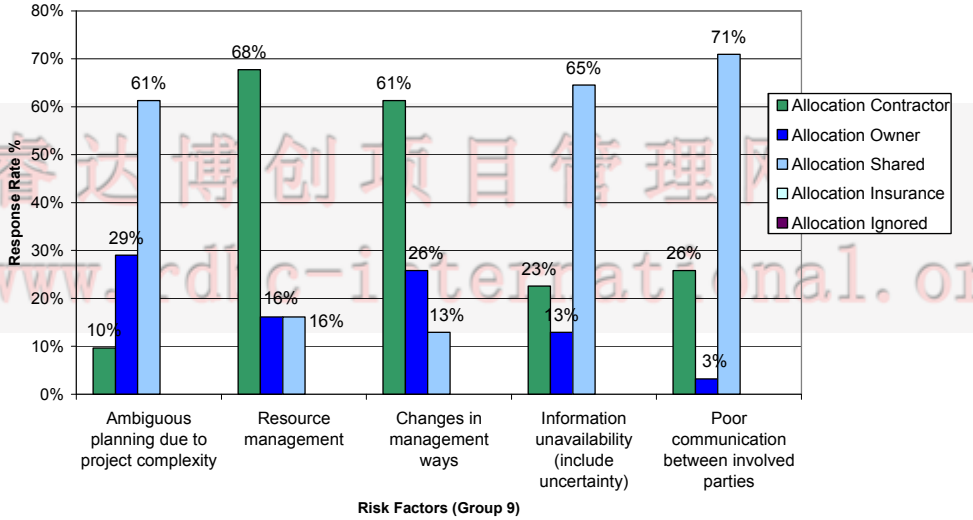

Figure 9 Management group risks allocation, contractors' perspective

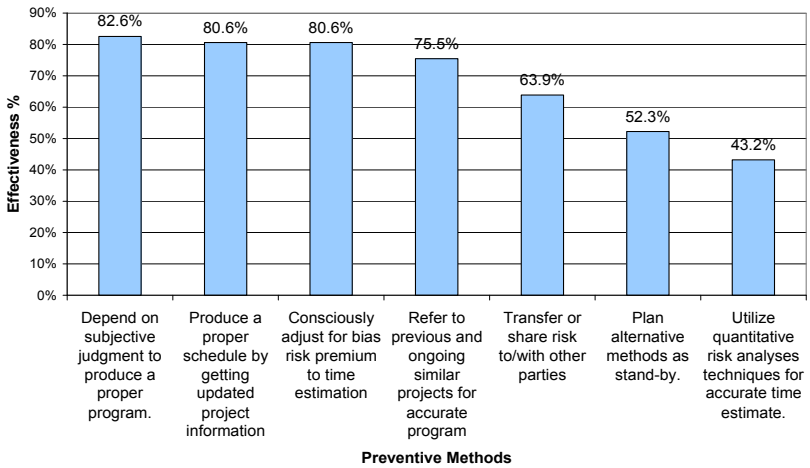

Figure 10. Preventive methods effectiveness, contractors' perspective

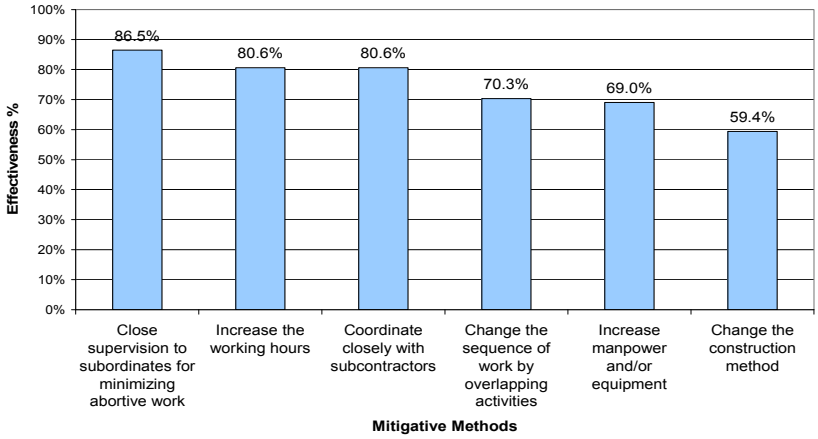

Figure 11. Mitigative methods effectiveness, contractors' perspective

Table 11. Risk factors ranking

No.	Risk Factors	Weight	Severity (1-10)
20	Financial failure of the contractor	279	9.0
36	Working at hot (dangerous) areas (close to IDF positions)	279	9.0
39	Closure	277	8.9
7	Defective design (incorrect)	264	8.5
19	Delayed payments on contract	260	8.4
35	Segmentation of Gaza Strip	258	8.3
38	Unstable security circumstances (Invasions)	258	8.3
44	Poor communication between involved parties	258	8.3
21	Unmanaged cash flow	256	8.3
12	Awarding the design to unqualified designers	243	7.8
23	Monopolizing of materials due to closure and other unexpected political conditions	243	7.8
18	Inflation	240	7.7
2	Supplies of defective materials	239	7.7
31	Undocumented change orders	236	7.6
22	Exchange rate fluctuation	232	7.5
26	Legal disputes during the construction phase among the parties of the contract	228	7.4
27	Delayed disputes resolutions	228	7.4
32	Lower work quality in presence of time constraints	228	7.4
41	Resource management	226	7.3
8	Not coordinated design (structural, mechanical, electrical, etc.)	225	7.3
30	Gaps between the Implementation and the specifications due to misinterpretation of drawings and	225	7.3
13	Unavailable labor, materials and equipment	222	7.2
17	Poor communications between the home and field offices (contractor side)	222	7.2
28	No specialized arbitrators to help settle fast	222	7.2
1	Occurrence of accidents because of poor safety procedures	221	7.1
40	Ambiguous planning due to project complexity	215	6.9
10	Lack of consistency between bill of quantities, drawings and specifications	211	6.8
5	Difficulty to access the site (very far, settlements)	207	6.7
15	High competition in bids	201	6.5
42	Changes in management ways	199	6.4
9	Inaccurate quantities	195	6.3
11	Rushed design	192	6.2
43	Information unavailability (include uncertainty)	191	6.2
3	Varied labor and equipment productivity	188	6.1
33	Design changes	187	6.0
14	Undefined scope of working	182	5.9
16	Inaccurate project program	179	5.8
6	Adverse weather conditions	173	5.6
25	Ambiguity of work legislations	171	5.5
34	Actual quantities differ from the contract quantities	169	5.5
24	Difficulty to get permits	166	5.4
4	Environmental factors	160	5.2
29	Rushed bidding process	152	4.9
37	New governmental acts or legislations	151	4.9

Allocation

The criterion for a risk to be appropriated to a particular category (contractor, owner, shared, insurance, or ignored), was that it should get at least a (60%) response rate. Those that failed to get such response rate in favor of any category were listed as undecided. Allocation of risk factors included in the questionnaire, according to the contractors' respondents, is appeared in Table 13. Contractors have allocated nine risks onto themselves, that means contractors accept (20%) of the risk factors, they have allocated eight risks onto owners, which signifies that (18%) of the risk factors the owner should handle, according to the contractors. The contractors also considered eleven risks as shared risks, i.e. (25%) of the risk factors should be shared. On the other hand, they were undecided about sixteen risks, that means the contractors failed to allocate (37%) of the risk factors. These results indicate that contracts' clauses applied in Gaza Strip ignore the majority of these risk factors.

Table 12. Most and least important risk categories as perceived by Contractors

Importance	Risk
High (Most important ranked first)	Financial failure of the contractor
	Working at hot (dangerous) areas (close to IDF positions)
	Closure
	Defective design (incorrect)
	Delayed payments on contract
Low (least important ranked first)	New governmental acts or legislations
	Rushed bidding process
	Environmental factors
	Difficulty to get permits
	Actual quantities differ from the contract quantities

4.3 Risk management actions, *contractors' perspective* Preventive actions

According to the survey results (Figure 10), contractors usually depend on their subjective judgment to produce a proper program catering for the most effective risk preventive actions. Judgment or subjective probability utilises the experience gained from similar past projects by the decision maker to decide on the likelihood of risk exposure and the outcomes. Judgment and experience may become the most valuable information source when there is limited time for preparing the project program. Construction, however, is subjected to a dynamic environment, that is why risk managers must constantly strive to improve their estimates. Even with near perfect estimates, decision making about risk is a difficult task. Thus, depending only on experience and subjective judgment may not be enough, and updated project information should be obtained and applied. Consequently, contractors considered getting updated project information and add risk premiums to time estimation at the project planning stage to be effective risk preventive method. Yet, this result was

Table 13. Risk allocation, Contractors' perspective

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

expected since taking into consideration such risks' premiums would increase the priced bid and would consequently decrease the probability of gaining the bid due to the highly competitive Gaza Strip construction industry market.

Make more accurate time estimation through quantitative risk analyses techniques such as Monte Carlo program was not considered to be an effective preventive method for reducing the effects of risk. The approach of risk analysis is largely based on the use of checklists by managers, who try to think of all possible risks. 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 result. Referring to similar projects to for accurate program was recommended by the practitioners to be an effective preventive method.

4.4 Mitigative actions

Figure 11 represents the six mitigative methods that have been proposed. The first mitigative method recommended by the respondents is close supervision to subordinates for the minimizing abortive work, and the last recommended mitigative method is change the construction method.

Increase working hours and 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. This could mean that the effort driven on site is one of the most important variables to project progress, since construction projects generally include many labor-intensive operations. In fact, as pointed out earlier, shortage of manpower in subcontractors' firms is one of the most serious risks causing 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.

5. 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 contractors are presented in Table 14.

It is recommended that contracting companies should compute and consider risk factors by adding a risk premium to quotation and time estimation. This trend has to be supported by governmental owner organizations and other agencies in the construction sector. Training courses should also be provided for engineers and project managers on how to deal and minimize risks in building projects. Contractors should endeavor to prevent financial failure by practicing a stern cash flow management and minimizing the dependence on bank loans. Contractors should learn how to share and shift different risks by hiring specialized staff or specialized sub-contractors. Contracting firms should utilize computerized approaches used for risk analysis and evaluation such as a risk package which integrates with widely used programs like Microsoft Project and Microsoft Excel.

Table 14. Most ten severe risk factors and allocation according to contractor's perspective

Rank	Risk Description	Allocation
1	Financial failure of the contractor	Contractor
2	Working at hot (dangerous) areas (close to IDF positions)	Shared
3	Closure	Shared
4	Defective design (incorrect)	Owner
5	Delayed payments on contract	Owner
6	Segmentation of Gaza Strip	Undecided
7	Unstable security circumstances (Invasions)	Shared
8	Poor communication between involved parties	Shared
9	Unmanaged cash flow	Contractor
10	Awarding the design to unqualified designers	Owner

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