

Using risk heat map approach as a tool to manage enterprise financial and zoning threats in the construction industry in Iraq

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Abstract —the goal of the research is to achieve the financial and zoning threats management by conducting management steps (defining ,analysing and finding the suitable response actions . A total number of 45 questionnaire forms were distributed to the public sector only ,with a returning percentage of (91.11%) from the total sample size. Research finding shows that (7.69%) of the financial threats are located in the green zone witch consider low risk factors , while a percentage of (38.46%) of the gathered threats are located in the yellow zone witch is a moderate threat zone . Percentage of (53.84%) of the financial threats are located in the brown zone witch can be describes as a high threat factors .There were no threats located in the red zone (extreme risk zone). In another hand for the zoning threats the findings shows that since this research only contain four zoning threats only one of them are located in the green zone with a percentage of 25% from the gathered zoning threats . The remaining zoning threats are located in the yellow zone (moderate threat zone) .There were no zoning threats located in the red zone .

Keywords —heat map, financial and zoning threats, project risk management, qualitative risk analysis .

I. INTRODUCTION

Heat map is an important method to show the results of the qualitative assessment approach visually and in a meaningful way. The assessment is a critical step in the management process, it's involves in fining the probability of threat occurrence and the impact on the construction projects major goals (time, cost and quality).Heat map are an approach to prioritize and rank threats all that done by multiplying the probability by the impact the result known as a risk score which can be allocated in different coloured zones witch reflect the importance of the threat [2].

Basically each heat map has gradient in colours starting from the low risk zone witch represented by green colour, through the yellow colour which represent the moderate threat zone and ends up with

the red colour zone witch represent the high threat zone , depending on how much important changes in impact and /or probability heat maps can be customized to show more details about what types of threats need more attention[3].

In this research the researcher used 5X5 Grid the designed heat map contain four ranges of colours gradient starts from dark Green (low risk) through yellow (moderate risk) to orange (high risk) ends up to dark red (very high or extreme risk) [3], [5]and[1].

Upgrading of an effective heat map has several boundaries – understanding the organization risk appetite which can be defined as the amount of risk that the company is willing to take in order to achieve their strategic goals and the level of impact that would be material to the company[2].

The benefit of the heat map can be summarized as the following [2]:

- 1-Its provide the organization with a historical and visual view while making decisions. .
 - 2-Its an effective tool in dealing with different size projects threats .
 - 3-Its help in defining the gaps in the current risk management process held by and organization.
 - 4-It is simple to use and to understand the finings by management team.
 - 5- Increase the concentration on the company ability to take the risks in order to achieve their strategic goals
 - 6-Its provide a great integration of the risk management plan for the whole project .
- So basically the components of heat map are probability of occurrence and the impact on the enterprise objectives . table (1) and table(2) shows the probability and impact rating system

score	impact	descriptor
1	Very low	Negligible effects
2	Low	Delay will occur in fulfilling the project objectives

3	Moderate	Delay in accomplishing the project objectives .
4	High	Program or project re-design, re-approval and re-do required
5	Very high	Project or program irrevocably finished; objective will not be met

Table (1) : impact rating system [5].

score	descriptor	How likely %
1	Very low	less than 5
2	Low	5 - 25
3	Moderate	25 - 55
4	High	55 - 90
5	Extreme	90 - 99

Table (2) : likelihood rating system [5].

Finally , the most effective response actions chosen for this study are (accept ,transfer ,mitigate and avoid) .

Avoid: threat avoidance strategy can be done by removing the cause of the threat or by adjusting the project management plan(implementation of the project items in different ways) while maintain the enterprise major goals from the threat [4].

Avoidance strategies include :changing or eliminating the work item that have the threat , increasing the resources (materials, labourers or both) , using new technology and avoiding the activities that could lead to threats). Not all the threats can be eliminated or avoided , but this approach considered to be the first action that need to be taken in consideration because of the cost and time factors since the other approaches can be expensive or time-consuming [6] .

Accept : this approach is used when the project risks are unable to be eliminated. Generally there are two main types of acceptance strategy .Passive acceptance approach is basically means to do nothing towards the threat, no plans and actions are used to avoid ,eliminated or transfer the threat.In another word it's the acceptance of the threat consequences when it occur. This approach is used when it is more cost effective to accept the effects of the threat than to spend resources or time in order to develop plans to deal with the threat consequences .This approach is also used when the risk management team were unable to come up with suitable response actions and must accept the threat and its effect of the enterprise goals . Active threat acceptance approach is used when the risk management team choose to make a plan and apply it when the threat occurs . Also this strategy include updating and upgrading the contingency plans to deal with the threats [4].

Transfer :it is done by transferring the threats with its financial effect to another party , the threat has not terminated yet , but the whole responsibility of getting rid of it now considered the third party responsibility . The threat transferring process must be done if the third party was competent ,efficient and qualified to take the necessary measures to reduce the importance of the threat .In certain cases the threat transferring process may increase the threats due to third party inefficiency[4].

Mitigate: the main aim of the mitigation process is to reduce the likelihood that the threat will occur and /or to reduce the threat effect , the result of that is to bring the threat to an acceptable level, all that done by different approaches that may be effective to reduce the risk zone. In spite of the mitigation process might has high cost or it will take more time to accomplish, but it is an effective tool in reducing the threat effect [4].

II. RESEARCH IMPORTANCE

- 1- The study focus on ranking the financial threats it is also involved in (defining threats , analyzing them and finding the effective response actions).The integration of these tools will yield an effective tool in enterprise risk management .
- 2- The study considered a good source of useful information that could be important to the project managers and decision makers .
- 3- Financial and zoning risk factors considered an important threats that effect achieving the project goals ,beside the poor studies and researches in this aspect in the Iraqi construction industry.

III. RESEARCH METHODOLOGY

It is consist of three major stages which can be summarized as the following:

- 1-gathering information's
- 2-preparaing the open questionnaire forms
- 3-Result analysis

1- Gathering information's

Since the study focused on the financial and zoning risk management therefore all the information were collected from the construction contracts From the ministry of construction and housing in the republic of Iraq. A total number of 25 contracts were gathered .the type of construction contracts were for building schools ,hospitals ,and public buildings.

2- preparing the open questionnaire forms

because of the study concern about ranking the financial and zoning threats in the Iraqi construction industry by using the heat map tool and finding out the effective response actions for each type of risk , therefore the open questionnaire forms consist of two main parts , the first part is concern about research sample personal qualifications ,while the second part concern about conducting the probability and the impact for each financial threat .table(3)below shows an example of the open questionnaire form. For this research a total number of 40 questionnaire forms were distributed which consider as a sample size for this research .

The Questionnaire forms were distributed between several contracting companies which all belong to the ministry of construction and housing . table (3) below shows the construction contract companies that were selected as a state (public) sector . The private and the mixed sectors share in this study were 0%.

No	Organization	No. of respondents
1	Al-Mansour Contracting Company	18
2	Al-Rasheed Contracting Company	15
3	Hammurabi Contracting Company	6
4	Ashur Contracting Company	6
Total		

Table (3): Number of Respondents and their Organizations

3- Result analysis

It is consist of three main stages :

Stage one: analyzing the personal qualifications for the research sample it is an important to know the qualifications and the abilities of the individuals that participates in answering the questionnaire forms . several factors are adopted to assess the research sample in order to obtain accurate result ,factors like (engineering specialization,years of experience and academic certificates) are used in this study.

In order to get all the information an analysis process was made , figure (1) below shows the engineering field for the selected research sample .its indicated that the greatest portion was for civil engineers with a percentage of 64%from the research sample while a percentage of 27% from the research sample was for engineers with architecture degree . Finally, the least percentage was 9% from the research sample which represent the mechanical engineers .

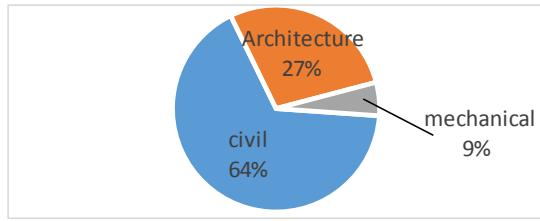


Fig.(1)shows the engineering field for the research

Figure(2) below reflect the experience years for the research sample. The percentage of the engineers with and experience from (1-5)years was 14% while the percentage of engineers with an experience from (6-15)years was about 34% .the biggest percentage was for engineers with years of experience from (16-25) years was about 41% and the lowest percentage was about 11% witch is represent the engineers with over 25 years of experience .

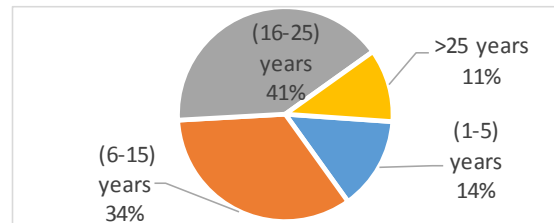


Fig.(2) show the research sample years of experience .

Finally the figure (3) below shows the research sample educational attainment .the biggest percentage was for the BSc holders with a percentage of 75% of the research sample .while the percentage of 14% was for master degree holders .The lowest percentage was 11% which is represent the engineers with a PHD degree.

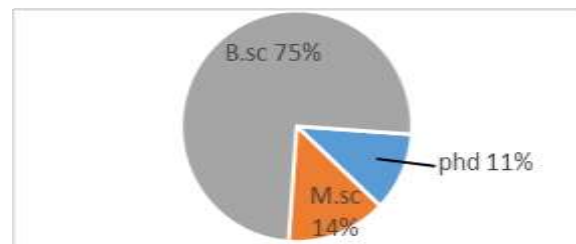


Fig.(3) show the research sample academic certificates .

Stage two : qualitative assessment

The analysis mechanism for the gathered financial and zoning threats from the Iraqi construction contracts was simple process , by multiplying the probability of occurrence by the impact on project goals the result will reflect the threat importance zone . the figure (4) below shows the suggested heat map by the researcher which is adopted from [3], [5] and [6].

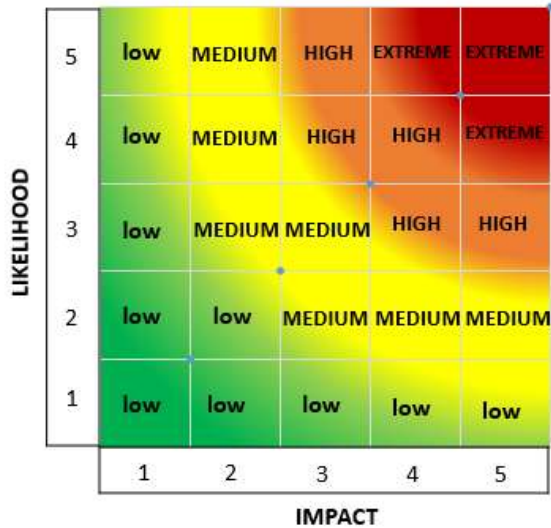


Fig (4) shows the suggested heat map

For financial threats :

The qualitative assessment for the gathered zoning threats can be seen below :

NO.	Financial Risk factor	Likelihood	impact	score	Zone	impotency
1	The delay in the completion of work item because of contractor's lack of fund (R1)	3	4	12	high	high
2	rise in fuel and construction materials prices and increasing the tax rates . (R2)	3	3	9	medium	medium
3	Financial allowances for completion the work items is non – sufficient. (R3)	3	4	12	high	high
4	delay in paying the contractor his Financial allowances (R4)	3	5	15	high	high
5	fluctuation of currency rates (R5)	2	2	4	low	low
6	A significant rise in rebar prices (R6)	2	4	8	medium	medium

7	Disagreement on deductions ratio (R7)	2	3	6	medium	medium
8	Lack of control over cash flow(R8)	3	4	12	high	high
9	Funding Cut Out suddenly and unexpectedly(R9)	3	5	15	high	high
10	Contractor demands The price difference because of high prices of materials due to delays (R10)	2	3	6	medium	medium
11	The bankruptcy of the contractor and his inability to complete the project(R11)	3	5	15	high	high
12	Late issuance of the country financial budget for Construction projects (R12)	3	3	9	medium	medium
13	fragmentation of funding (R13)	3	4	12	high	high

table (4) shows the financial threats assessment

Researcher also allocate the threats in the suggested heat map which can be seen below :

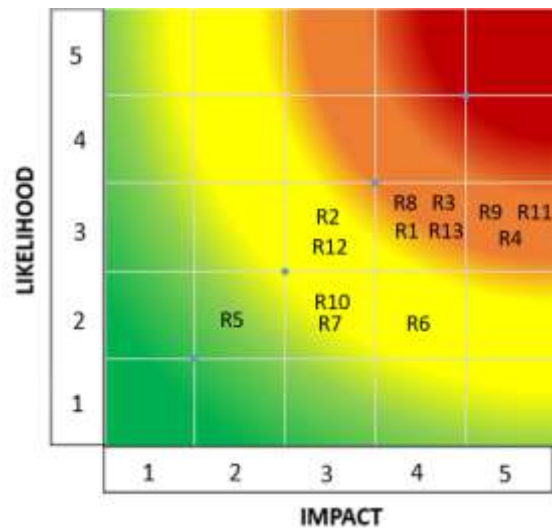


Fig. (5) shows the location of financial threats factors on the heat map

Response actions for Financial threats can be shown in the figure below :

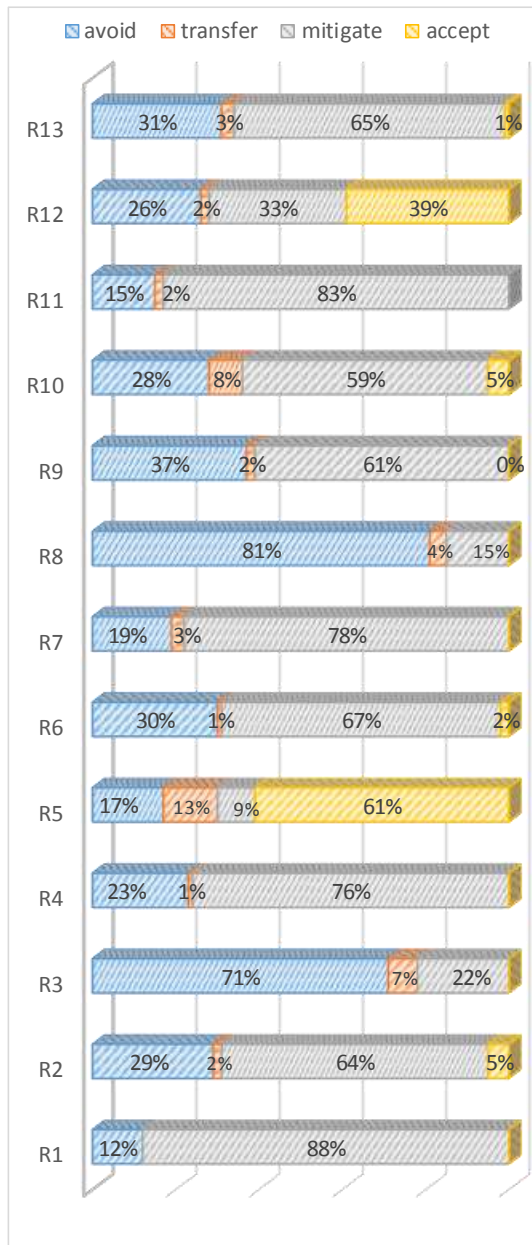


Fig.(6) financial threats response actions

From the figure above we indicate that the highest percentage of particular answer represent the effective response action .for example let take the fragmentation of funding as a an example .we notice that the highest percentage of the answers is 65% is goes to the mitigate action . that’s means the most effect response action in this case scenario is mitigate the threat by reducing the probability/impact of the threat.

for the zoning threat:

The qualitative assessment for the gathered zoning threats can be seen below :

NO.	Zoning Risk factor	Likelihood	impact	score	zone	impotency
1	The appearance of groundwater during excavation work (R1)	3	4	12	High	High
2	The different nature of the ground (R2)	2	3	6	Medium	Medium
3	existence of electrical cables with a networks of irrigation water pipes which did not specify in the charts (R3)	2	5	10	Medium	Medium
4	Selection of the project area in a remote place, difficult to reach (R4)	2	4	8	Medium	Medium

table (5) shows the zoning threats assessment

Researcher also allocate the threats in the suggested heat map which can be seen below :

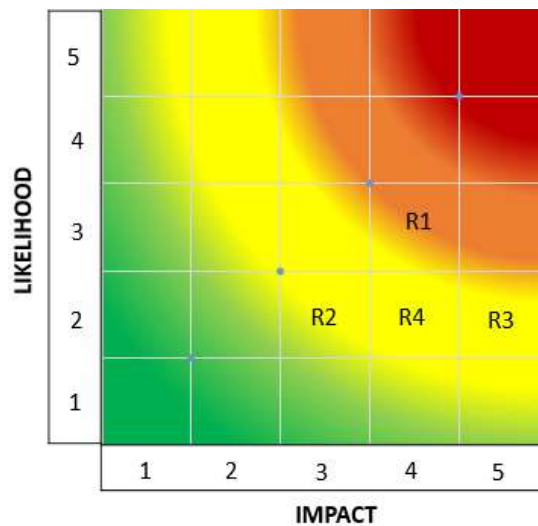


Fig. (7) shows the location of zoning threats factors on the heat map

response actions for zoning threats can be shown in the figure below :

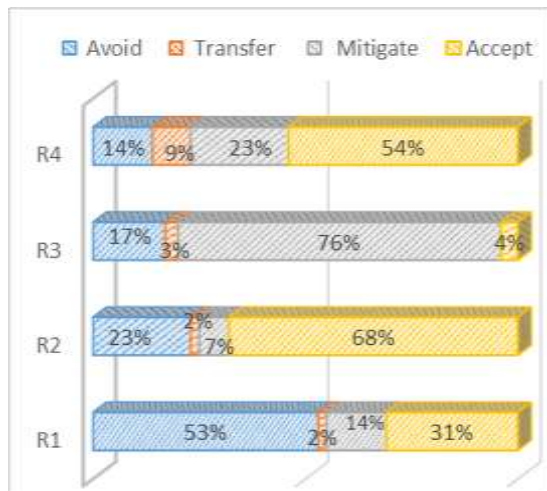


fig.(8) response action for zoning threats .

From the figure above we indicate that the highest percentage of the answers represent the effective response action according to the questionnaire results , for example the effective response action for the zoning threat (the difficult nature of the ground) is Accept ,this threat has the highest percentage of the answers witch is 68% that's why acceptance of the threat was more suitable one .

IV.CONCLUSIONS

- 1- The study found that using heat map with different colors gradient is as simple as effective tool to prioritizing the financial and zoning threats .
- 2- The study shows that the reality of risk management in Iraq is to take actions when the risk occur, with no pre plans to face the threats by 78% of answers of the research sample.
- 3- The study also found that around 71% of the public sector projects have no team that specializes in project risk management.

- 4- Response actions for financial threats were to be (15.38%) for avoid and accept actions, while the percentage of mitigate action is only (69.23%) from the total response action according to the research sample answerers . The study also shows the response actions for zoning threats which around (25%) for both of the avoid and mitigate actions and a percentage of 50% from the research sample used threat acceptance action. For both of the financial and zoning threats the threat transfer action were to be zero percentage . There is no certain strategy that can be used to face the current or future threats . The effective strategy depends on specific criteria's such as threats type and size ,but all these documented facts about the current threats status are considered to be a historical data that might be useful to the decision makers .

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