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Proposed Risk Matrix for Offshore Projects

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Abstract: *Risk matrix is an effective tool used to give a visual sense of security for activities included in a certain project. It is usually used in risky fields such as oil, gas, and mining. This tool can be modified to define the expected risk over the environment for projects in environmental impact assessment studies. This paper aims to introduce a New Proposed Risk Matrix and compare it with the Traditional Project Risk Matrix. The comparison was carried out by applying both techniques to an existing project consisting of an offshore platform and a pipeline with a previous environmental and risk assessment study. Parameters of comparison included judgment of each action using both matrices. Also, an evaluation of each phase and the whole project performed was done. The methodology of assessment was illustrated and final comparison between the resulted was included.*

Key words: *Risk matrix, Offshore Projects, Offshore Platform, Pipelines, Environmental Impact Assessment, Risk Assessment, Traditional Project Risk Matrix, New Proposed Risk Matrix.*

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I. Introduction And Literature Review

With the evolution of nowadays development and the continuous need for energy resources, the number of oil projects in the offshore spots increase. When discovering and producing oil from these spots, it is always the job of transmitting it to onshore storage tanks. One of the most common methods for this transmission is using pipelines and offshore platforms. These projects always involve expected hazards to the marine environment such as diesel combustion emissions, water use, discharge and spillage of oil due to undesirable leakage, and the like. So, Environmental Impact Assessment (EIA) using risk matrices are of great importance.

Wilford et al.[10]. introduced a 4x4 Traditional Project Risk Matrix (TPRM) to deal with all actions during a certain project (see Table no. 1). They defined the likelihood degrees as in **Error! Reference source not found.**, the risk degrees as in Table no. 3, and the four categories of the degrees of consequences as in **Error! Reference source not found.**4.

Error! Reference source not found.: TPRM after Wilford et al.

Consequences \ Likelihood	1	2	3	4
1	H	H	M	L
2	M	M	L	L
3	L	L	N	N
4	N	N	N	N

Table no. 2: Likelihood degrees

Degree \ Likelihood	Definition
1	High probability, frequency, or long duration
2	Moderate probability, frequency, or medium duration
3	Low probability, frequency or short duration
4	Unlikely event

Table no. 3: Risk degrees

Risk Degree	Definition
H	High significance (requires immediate action)
M	Medium significance (requires additional control)
L	Low significance (requires management)
N	Not significant (requires monitoring)

Table no 4: Degrees of Consequences

Degree	Legal Compliance	Environment	Social	Costs
1	Controlled by legislation, guidance, policy or standards and not in compliance	Extensive impact over wide area; long term; affects large or several environmental attributes; or global impact	Displacement or interruption of local communities; effects extend to regional or national	Major remedial cost greater than or as large % of project expenditure
2	Controlled by legislation, guidance, policy or standards; and will be in compliance	Impact extends over reasonable area; beyond site boundary to nearby vicinity; medium term; local environment affected	Effect extends to local communities	Moderate remedial cost as % of project capital expenditure
3	Controlled by legislation, guidance, policy or standards and in compliance (verifiable)	Localized impact within site boundary; short term; negligible effects on environmental attributes	Negligible effects on people	Low remedial cost
4	Not controlled by legislation, guidance, policy or standards	No impact	No impact	No response required or no appropriate remedial measures

Somi et al.[9] introduced a Risk Breakdown Matrix (RBM) for the construction of onshore wind farm projects. They identified the construction work packages and compared it with other projects. **Aboud et al.**[1] applied magnetic gradient techniques including Euler deconvolution and analytic signal methods to the aeromagnetic data to define the geological trends and depths of subsurface geologic structures to evaluate hazards in the region of Gulf of Suez, Egypt. **Cui Q. and Erfani A**[7] assured that risk detection and allocation are increasingly important to successful project delivery for mega infrastructure projects. They examined the effectiveness of existing methods to identify construction risks and then present a novel approach to risk detection using case-based reasoning and text mining techniques. More information about the subject is given in the research works listed in "Reference".

In the present study, a New Proposed Risk Matrix (NPRM) is developed and compared to TPRM. Data from an existing project consisting of an offshore platform and a pipeline was used in the comparison. It is hoped to add a new insight to the phenomena.

II. Implementation Chart

In this study, the implementation chart based mainly on seven simple steps is adopted. The main purpose of this chart is to determine the potential and the overall risks for the single action. It can be used as a manual for the NPRM. Details of these seven steps are given in Figure no. 1.

III. Case Study

The case study is the project of a fixed offshore platform and a pipeline for oil transmission to onshore. The project is located in Gulf of Suez, one of the oldest oil production regions in Egypt. The project consultant introduced an EIA using a TPRM. Project actions were evaluated by NPRM. Then, the results of both matrices were discussed and compared. Abbreviations and symbols used in the two assessments are given in Table no. 5. The 37 studied actions are shown in Table no. 6. Action number, the unit it belongs to (platform or pipeline), the phase it occurs in, its source of impact, and its aspect and impact are also illustrated.

Table no. 5: Used abbreviations and symbols

Symbol	**Meaning**	**Symbol**	**Meaning**
PF	Platform	PCM	Pre-Commissioning
PL	Pipeline	COM	Commissioning
CON	Construction	PRO	Production
INS	Installation	MAN	Maintenance
NRT	Non-Routine	M	Medium Significance
H	High Significance	L	Low Significance
N	Not Significant	FPSO	Floating Production Storage and Offloading

(1) Choose the suitable description of the action's likelihood & its equivalent no.

Degree	Likelihood	Equivalent No.
Very High	Almost certain or frequent	1.00
High	Likely or probable	0.60
Medium	Possible or occasional	0.35
Low	Unlikely or remote	0.20
Very Low	Rare or improbable	0.10

(2) Choose the suitable description of the action's history & its equivalent no.

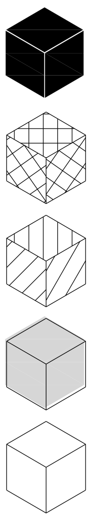
Degree	History	Equivalent No.
Very High	Happens regularly	1.00
High	Happens several times	0.60
Medium	Happened in this country	0.35
Low	Has occurred in this industry	0.20
Very Low	Has never happened	0.10

(3) Choose the suitable description of the action's consequences & its equivalent no.
(Note there are 10 different factors of consequences with 10 different equivalent numbers)

Degree	Very High	High	Medium	Low	Very Low
Equivalent No.	100	60	35	20	10
Environment	Disaster	Severe damage	Contained impact	Low impact	No impact
Safety	Death	Serious injuries	Medical treatment	First aid	No injuries
Health	Crisis	Regional	Local	Negligible	No impact
Socio-Economic	Catastrophic	Critical	Marginal	Negligible	No impact
Finance	Massive cost	Huge cost	Medium cost	Low cost	Negligible
Reputation	Extreme damage	Huge damage	Medium damage	Low damage	None
Legal Compliance	Not controlled	Major violation	Controlled violation	Minimum damage	No violation
Region	Wide area	Regional area	Beyond site	Within site	No impact
Duration	Permanent	Long term	Medium term	Short term	Instant impact
Mitigation	Impossible	Long term	Medium term	Quick	No need

(4) Calculate the potential risk over each factor
(Equals multiplication of the 3 equivalent numbers)
(Note that there are 10 different potential risks)

(5) Calculate the overall risk degree for the action
(Equals average mean of the 10 potential risk degree)



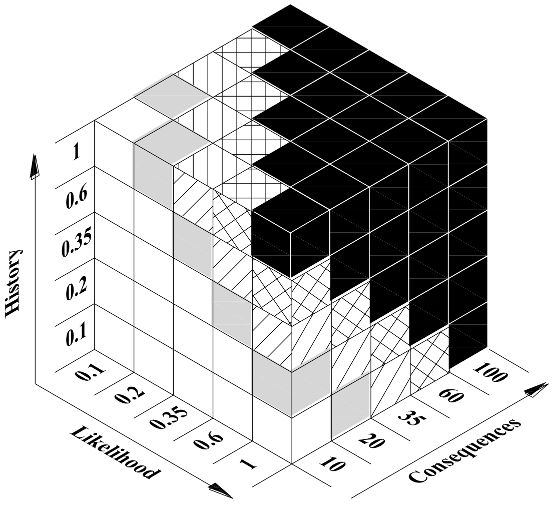
Risk >= 10 (Catastrophic)

6 <= Risk < 10 (Major)

3.5 <= Risk < 6 (Moderate)

2 <= Risk < 3.5 (Minor)

Risk < 2 (Insignificant)



(6) Judge the resulted risk degrees using the adjacent legend

(7) Actions have catastrophic, major or moderate overall risk degree requires mitigation

Figure no 1: Implementation chart of NPRM

Table no. 6: Project actions assessed by both TPRM and NPRM

No.	Unit	Phase	Source	Aspect	Impact
1	PF	INS	Installation vessels	Diesel combustion emissions	Air quality
2	PF	INS	Installation vessels	Water use, discharges and spillage of oil	Water quality
3	PF	INS	Installation vessels	Disposal of treated sewage	Water quality
4	PF	INS	Installation process	Disturbance of seabed and contamination from sediments	Water quality
5	PF	INS	Installation process	Construction solids and other wastes	Waste
6	PF	INS	Installation vessels	Solids and other wastes	Waste
7	PF	INS	Installation vessels	Discharges from vessels	Marine ecology
8	PF	INS	Platform footprint	Loss of benthic and marine habitats	Marine ecology
9	PF	INS	Installation process	Lighting, noise and vibrations from installation and piling	Marine ecology
10	PF	CON	Construction material	Supply of steel for jacket and topsides	Resource use
11	PF	COM and PCM	Power required for testing of equipment	Combustion emissions	Air quality
12	PF	COM	Testing of seawater and drainage systems	Use and discharge of seawater	Water quality
13	PF	COM	Support vessels for testing	Discharges from vessels and sewage	Water quality
14	PF	COM and PCM	Replacement of faulty or replaceable parts	Generation of solid waste	Waste
15	PF	PRO and MAN	Power required for production and testing of equipment	Combustion emissions	Air quality
16	PF	MAN	Venting from closed drains caisson	Releasing of hydrocarbons and gasses	Air quality
17	PF	MAN	Drainage from platform	Discharge of oily water	Water quality
18	PF	PRO	High temperature of production fluids	Changes to seawater temperature	Water quality
19	PF	MAN	Manned activities at the platform	Generation of solid waste	Waste
20	PF	PRO	Platform existence	Restricted areas for fishing vessels and other marine activities	Socio-economic
21	PF	NRT	Ship collision, seismic event or design failure	Spillage of chemicals	Water quality
22	PF	NRT	Ship collision, seismic event or design failure	Spillage of hydrocarbons	Water quality
23	PL	INS	Installation vessels	Diesel combustion	Air quality
24	PL	INS	Installation vessels	Water use, discharges and spillage of oil	Water quality
25	PL	INS	Installation vessels	Disposal of treated sewage	Water quality
26	PL	INS	Installation process	Mobilization of existing contamination in sediments	Water quality
27	PL	INS	Installation process	Construction solids and other wastes	Waste
28	PL	INS	Installation vessels	Solids and other wastes	Waste
29	PL	INS	Installation vessels	Discharges from vessels	Marine ecology
30	PL	INS	Pipeline and mattresses installation	Loss of benthic and marine habitats	Marine ecology
31	PL	INS	Installation process	Lighting, noise and vibrations from installation and laying	Marine ecology
32	PL	CON	Construction material	Supply of steel for pipes	Resource use
33	PL	COM	Pipeline hydrotesting	Use and discharge of seawater	Water quality
34	PL	COM	Cleaning and gauging pigs	Generation of waste	Waste
35	PL	MAN	Cleaning and gauging pigs	Generation of waste	Waste
36	PL	NRT	Umbilical instability, anchorage or design failure	Spillage of chemicals	Water quality
37	PL	NRT	Pipeline instability, anchorage or design failure	Spillage of hydrocarbons	Water quality

IV. Risk Evaluation by The Proposed Matrix

Prior to the evaluation process, complete detailed discussion for every factor and parameter included in the NPRM is introduced. This is to understand the reason for the adaptation of the effect of this factor, and weight given to it when affecting each action.

IV-1. Likelihood: The phase of the project is the corner stone in determining the likelihood degree of each action. Construction, installation, pre-commissioning, and commissioning phases, take place only in a short time of the project as compared with the production and maintenance phase that lasts along all the project lifetime.

IV-2. History of Occurrence: There are many fixed platforms in Egypt that vary according to size, location, functions handled, and product extracted. There are different units used like FPSOs in deeper water depths in the Mediterranean. The Gulf of Suez has a long history of ship collision.

IV-3. Environmental Impact: Resource use has almost no impact on the environment. Spillage of hydrocarbons can be a disaster in the Gulf due to its bad effects on the aqua life. The effects of spillage depend on the amount and concentration of the leaked hydrocarbon.

IV-4. Safety: All of the project activities have no serious or direct threat on public safety or human lives.

IV-5. Health: Effects on air or water qualities have indirect impacts on public health as the project location is offshore and the venting process is accomplished during maintenance. Spills and leakage affect the public when it reaches swimming areas and fishing industry so, they have higher effects on health.

IV-6. Socio-Economic: Spillage of hydrocarbons is a real threat for the fishing and tourism industries in the region, while a chemical spill has less effect. The existence of platform can distract and redistribute fish and fisheries from project location. Loss of benthic communities may have low impacts on fishing.

IV-7. Financial: Trapping of oil spills and recovery of hydrocarbons are operations that needs high cost regarding equipment, experts, penalties, etc. Other activities have almost no financial impacts.

IV-8. Reputation: Hydrocarbons and/or chemicals spills affect the operator and the contractor history in the region. High cost and professional measures should be used to regain the region reputation.

IV-9. Legal Compliance: Major legal violation occurs in case of hydrocarbons or chemicals spillage. Measures to comply with environmental laws and regulations should be taken.

IV-10. Region: Spills affect regional areas, and all other impacts are within project site. It is unlikely for the impacts to reach the Red Sea and affect other surrounding countries. Resource use has no regional impacts.

IV-11. Period: Loss of marine habitats is permanent. Power supply emissions for production, restriction for fishing boats, resource use and accidental spill impacts will stay for a long period.

TV-12. Mitigation: Mitigation is almost impossible for loss of marine habitats caused in these actions. Long term mitigation is required for restricted areas for fishing, resource use and accidental spill. No mitigation is required for effects on disturbance of seabed, temperature pollution and effects on air quality except venting of hydrocarbons.

Table no. 7 shows briefly how the degree for each action over each factor was classified. It is noticed that sometimes actions were categorized according to its phase and other times according to its impacts.

Table no. 7: Actions' classification for NPRM

Degree / Factor	Very High	High	Medium	Low	Very Low
Likelihood		Production phase	Maintenance phase	The rest of phases	Non-routine events
History		Non-routine events, restriction for fishing	The rest of actions		
Environment	Hydrocarbons spill	Chemicals spill	Installation process, temperature pollution, hydrocarbons wastes, hydrotesting	The rest of actions	Resource use
Safety					All actions
Health			Non-routine events	Venting	The rest of actions
Soci-Economic		Hydrocarbons spill	Chemicals spill, existence of platform	Loss of benthic communities	The rest of actions
Financial	Hydrocarbons spill	Chemicals spill			The rest of actions
Reputation	Non-routine events				The rest of actions
Legal Compliance		Non-routine events		The rest of actions	Diesel emissions, resource use
Region		Non-routine events		The rest of actions	Resource use
Duration	Loss of benthic communities	Non-routine events, power supply, restriction for fishing, resource use	Disturbance of seabed	Installation process	Wastes

Factor \ Degree	Very High	High	Medium	Low	Very Low
Mitigation	Loss of benthic communities	Non-routine events, restriction for fishing, resource use	Treatment of sewage	Venting, wastes, effects on water quality	Temperature pollution, disturbance of seabed, effects on air quality

V. Comparison between TPRM and NPRM

The present study, as was shown earlier, proposed a new developed risk matrix (NPRM) and compared it with the traditional project risk matrix (TPRM). Figure no. 2 shows the risk values determined by both matrices. The X-axis represents action number, right Y-axis and left Y-axis represent risk degree by TPRM and NPRM, respectively. The diamonds symbols give the risk calculated by TPRM. The squares give the risk calculated by NPRM. Clear is that there exist major differences between the risk calculated by both matrices for each action. NPRM tells that every action has its own hazard and all actions' hazards lie between low (L) and medium (M) levels. Many actions have no hazards if calculated based on TPRM. NPRM gives results that comply with the real experienced actions' consequences.

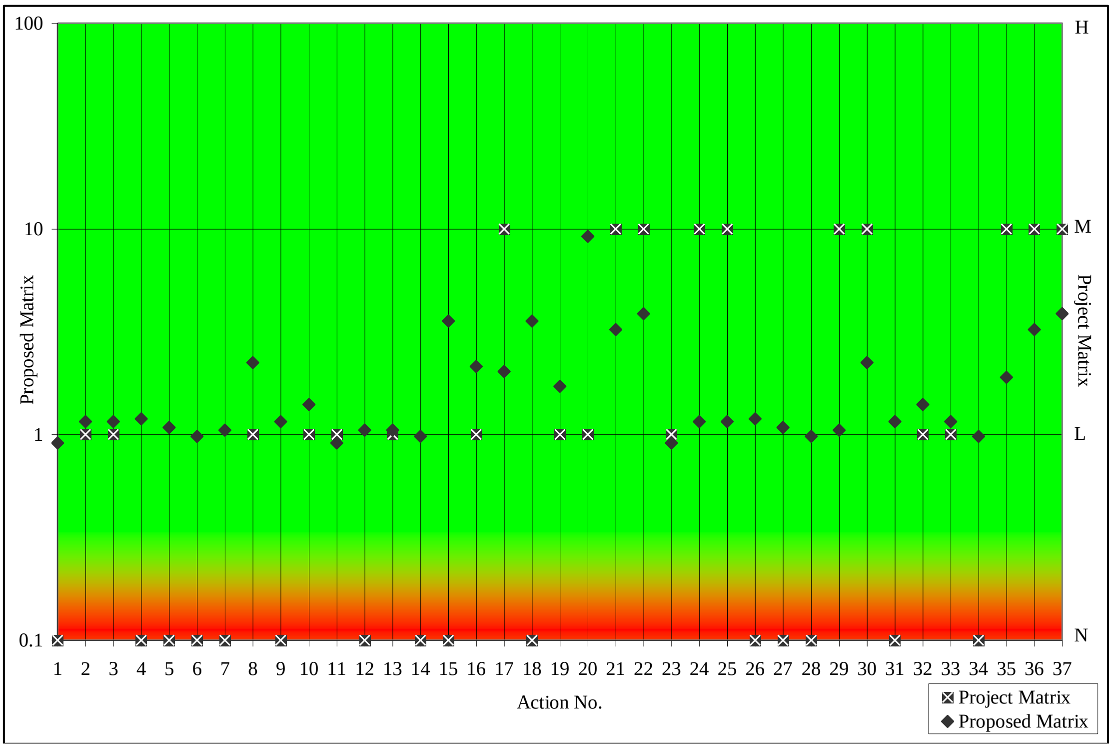


Figure no 2: Graphical Comparison

V-1. Actions Mitigation: Regarding Figure no. 2, TPRM and NPRM resulted that ten and five actions require mitigation, respectively. The first response to these results concludes that TPRM is more conservative. However, a thorough look tells that TPRM fifteen actions have no risk at all. On the other hand, there are additional nine actions that have potential risks in NPRM evaluation because of the more convenient potential risks.

V-2. Deaf Results: It is noticed that the TPRM results are limited into four degrees (high (H), medium (M), low (L) and non-significant (N)) while NPRM identifies the risk as a number for every action. This means that even inside the single risk degree risk can be different from one action to another. For example, both actions number one and thirty-five are within very low risk degree but, from Figure no. 2, the risk factors for the two actions are 0.91 and 1.90, respectively. This means that action thirty-five is riskier than action number one. NPRM gives wider range for judging on every action and its results are not deaf like the results of TPRM.

V-3. Actions Comparison: Referring to Figure no. 2, there are three cases of results. Either both matrices give almost the same risk level, TPRM gives higher risk, or NPRM gives higher risk degree. In Table no. 8, both risk degrees resulting from TPRM and NPRM are gathered. The comments explain why this difference exists. The risk calculated over each factor is given to give the feeling if the action has potential risks. Actions are arranged according to the project matrix assessment from riskier to less risky.

V-4. Critical Phases: Actions related to each phase are collected in Table no. 9 to follow the differences between the matrices. Every phase risk score was calculated by the proposed matrix.

The introduced results showed that both matrices nearly have the same results for construction, pre-commissioning, commissioning, and maintenance phases. NPRM decreased the significance of installation phase because it will not take much time compared with the total project lifetime unlike production phase, which occur nearly along the project lifetime. Non-routine events were slightly less risky by NPRM, but the phase risk score is showing that it has medium risk. That is the NPRM gives more realistic results regarding the phase and the effect of time in which the action takes place.

Table no. 8: Comparison between results of the two matrices

Action No.	Risk Degree (TPRM)	Environment	Safety	Health	Socio-Economic	Financial	Reputation	Legal Compliance	Region	Duration	Mitigation	Overall Risk (NPRM)	Comment on both Results
22	M	6.0	0.6	2.1	3.6	6.0	6.0	3.6	3.6	3.6	3.6	3.87	Both matrices give medium risk but it is noticed that actions have potential high effects on environment, finance and reputation while they are low on health and safety
37	M	6.0	0.6	2.1	3.6	6.0	6.0	3.6	3.6	3.6	3.6	3.87	
21	M	3.6	0.6	2.1	2.1	3.6	6.0	3.6	3.6	3.6	3.6	3.24	Unlikely nature of the action made its risk low instead of medium although it is medium over most of factors also, action has potential high risk on reputation
36	M	3.6	0.6	2.1	2.1	3.6	6.0	3.6	3.6	3.6	3.6	3.24	
30	M	1.4	0.7	0.7	1.4	0.7	0.7	1.4	1.4	7.0	7.0	2.24	Low risk instead of medium cause this action is unlikely in the meanwhile, it takes long period and hard in mitigation
17	M	4.3	1.2	1.2	1.2	1.2	1.2	2.5	2.5	2.5	2.5	2.02	Risk is medium over environment only and it is low in general because it is unlikely event
35	M	4.3	1.2	1.2	1.2	1.2	1.2	2.5	2.5	1.2	2.5	1.90	Risk is medium over environment only and it is very low in general because it is unlikely event
24	M	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.16	Very low instead of medium cause this action is unlikely
25	M	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	2.5	1.16	
29	M	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.05	
20	L	7.2	3.6	3.6	12.6	3.6	3.6	7.2	7.2	21.6	21.6	9.18	High instead of low cause it was experienced regularly in the past and it will certainly occur
8	L	1.4	0.7	0.7	1.4	0.7	0.7	1.4	1.4	7.0	7.0	2.24	It is clear that effects are hard in mitigation over long period and that what raised the risk a little bit

Action No.	Risk Degree (TPRM)	Environment	Safety	Health	Socio-Economic	Financial	Reputation	Legal Compliance	Region	Duration	Mitigation	Overall Risk (NPRM)	Comment on both Results
16	L	4.3	1.2	2.5	1.2	1.2	1.2	2.5	2.5	2.5	2.5	2.14	Potential effects over many factors especially on environment raised the risk degree
19	L	2.5	1.2	1.2	1.2	1.2	1.2	2.5	2.5	1.2	2.5	1.72	Low risk in general but has potential risks over some factors
10	L	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	4.2	4.2	1.40	These actions have low impacts in general but they occur over long period and hard in mitigation
32	L	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	4.2	4.2	1.40	
2	L	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.16	Both matrices evaluations were low risk but actions have potential effects on environment
33	L	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.16	
3	L	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	2.5	1.16	Both matrices give low risk but the action is a little hard in mitigation
13	L	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.05	Both matrices evaluations were low risk
11	L	1.4	0.7	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	0.91	
23	L	1.4	0.7	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	0.91	
15	N	4.2	2.1	2.1	2.1	2.1	2.1	2.1	4.2	12.6	2.1	3.57	Medium risk instead of nothing cause these actions are over a long duration and will certainly occur
18	N	7.4	2.1	2.1	2.1	2.1	2.1	4.2	4.2	7.4	2.1	3.57	
4	N	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	2.5	0.7	1.19	Very low significant instead of nothing but these actions have potential effects on environment and they take medium period
26	N	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	2.5	0.7	1.19	
9	N	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.16	Very low risk instead of nothing but these actions have relative risk over the environment
31	N	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.16	
5	N	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	1.4	1.09	
27	N	2.5	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	1.4	1.09	
7	N	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.05	Very low risk instead of nothing and risk is low over each factor
12	N	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	1.4	1.4	1.05	
6	N	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	1.4	0.98	
14	N	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	1.4	0.98	
28	N	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	1.4	0.98	
34	N	1.4	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	1.4	0.98	
1	N	1.4	0.7	0.7	0.7	0.7	0.7	0.7	1.4	1.4	0.7	0.91	

Table no. 9: Phases evaluation by both matrices

Phase	No.	Risk by TPRM	Risk by NPRM (Phase Risk Score)
Construction	2	Low significance	Very low significance (1.40 - Very Low)
Pre-commissioning	2	Divided between low significance and not significant	Very low significance (0.95 - Very Low)
Installation	18	10 actions were non significant, 4 low significance and 4 medium significance	16 actions have very low significance and 2 actions have low significance (1.21 – Very Low)
Commissioning	6	Divided between low significance and not significant	Very low significance (1.02 – Very Low)
Production	3	2 actions were non significant and 1 has low significance	2 actions were medium significant and 1 was high significant (5.44 – Medium)
Maintenance	5	1 action was non significant, 2 low significance and 2 medium significance	2 actions have very low significance, 2 actions have low significance and 1 action has medium significance (2.27 – Low)
Non-Routine Events	4	Medium significance	2 actions were medium significant and 2 were low significant (3.56 – Medium)

V-5. Project Evaluation: when using TPRM, it is hard to judge the project except by saying there are ten actions that need mitigation out of thirty-seven. However, using NPRM, the project risk score can be calculated and then accurately judged. In this project example, the overall risk equals 1.86. Therefore, the project have overall low significance and is accepted in general.

VI. Conclusions

In this work, a new proposed risk matrix (NPRM) was introduced. To check its performance, it was compared to the results of the traditional project risk matrix (TPRM) in calculating risks of actions in a project in Gulf of Suez, Egypt oil station that contains a platform and a pipeline. The following could be concluded:

- The disadvantages of TPRM sometimes make its judgment far from reality.
- The comparison between TPRM and NPRM for the case study showed that TPRM misjudged the project action hazards, potential risk for each factor, and the history of occurrence for some actions.
- NPRM revealed that some activities in the project case study have potential risk over some factors which did not appear in TPRM evaluation.
- NPRM gave the advantage for determining overall risk for each phase and for the whole project unlike TPRM.
- TPRM is limited into four degrees (deaf results) while, NPRM has the advantage of expressing the risk by a number that allows for fare comparison between different actions.
- Expressing the overall risk and potential risks by numbers in NPRM is very useful. The results are not deaf like results by TPRM, and the comparison process between activities and project phases are much easier. The numerical expression of risk will be very important in case of comparing between project alternatives.

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