International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 02 | Feb 2022 www.irjet.net p-ISSN: 2395-0072

Case Studies on Impact of Qualitative Risk Assessment Using Project Management Tools and Techniques

Ar. Hrushikesh A. Tarkasband[1], Prof. Ar. Sanjay D. Joshi[2]

[1]M. Arch (Architectural and Construction Project Management), SPSMBH's College of Architecture, Kolhapur
[2]SPSMBH's College of Architecture, Kolhapur, Maharashtra, INDIA

Abstract - *Study shows that there is lack of usage of risk assessment tools and techniques during construction project management and hence affects on project time management, costs and labor intensive. Also it increases the risks during project execution and has hazards on health and safety. Case studies have been conducted on commercial complexes so to study the use of qualitative risk assessment tools and techniques and its effect on project time management. The studies describe the risk levels of not adopting the qualitative risk assessment factors impacting on project time management and cost. The risk levels are being classified as low, medium and high. Hazards & risks are controlled on site when qualitative risk assessment is on practice. All well trained labors should always be health & safety on construction site. Accidents in construction site will be minimized while qualitative risk assessment improved. Quality & speed of labor work improves in low risk assessment. It is found that more heighted building causes high risk & less heighted building causes less risk. Also latest equipment materials that are tools & techniques should be arranged during construction work. So before construction of commercial shopping complex future risks should be found.*

Key Words: Qualitative risk assessment; Tools & techniques; Project management; Time management; Safety

1. INTRODUCTION

Risk assessment has become an important aspect of the construction industry's project management strategy. A qualitative risk assessment method is required for data-deficient construction and those with inadequate knowledge of ecological interactions. Where there is little data and understanding about the construction sector, the qualitative risk assessment method can help project managers and teams establish solid management strategies. Identifying risks, analyzing and evaluating the risk, and controlling the risk are all part of the risk assessment process.

In the construction business, project time management technologies and strategies play an important role. The use of appropriate project management tools and procedures is critical to the success of project management. It has been discovered that a lack of awareness and knowledge of tools and processes causes delays as well as financial loss. Many failures have happened in a significant number of contracting organizations in the last few years, according to local practices, making it critical to analyze existing project management techniques. In the construction business, it has been recognized that project management is becoming increasingly crucial. Our study will focus on the qualitative risk assessment with respect to impact of project time management tools & techniques on commercial shopping complex in Kolhapur city. This paper is intended to explore the project time management practices used by public owners, contractors, builders & end-users and to identify the major obstacles towards the efficient utilization of those practices.

This study will use work breakdown structures, bar charts, and linked bar charts, the critical path approach, resource leveling and smoothing, schedule crashing and fast tracking, schedule updating, and the program evaluation and review technique. Program evaluation and review technique (PERT), activity on arrow (AOA), activity on node (AON), bar chart, organizational breakdown structure (OBS), work breakdown structure (WBS), critical path method (CPM), and resource leveling are just a few of the management tools and techniques that have been investigated.

2. METHODOLOGY

Risk assessment & time management tools & techniques get impacted on benefits or loss of commercial shopping complex. Risk effects on time management & then time management gets affected on profit or gain of commercial shopping complex. So, qualitative risk assessment is very important factor in building construction industry.

Relevance:

Table 1: Cause & Impact study as per risk factor

Sr. No.	When	Cause	Impact
1	Risk is high	Time overruns or delay	benefit goes down in Commercial shopping complex
	Decision : Avoid the action or reduce the risk		
2	Risk is low	Time in control	benefit goes up in Commercial shopping complex
	Decision : Proceed with the action		
3	Risk is medium	Acceptable level of risk	prepared to be lost balanced against possible gain

Four case studies of commercial shopping complex in Kolhapur city are analyzed. The concept of commercial shopping complex is 'various shops in one building block'. So there are various shops & offices in commercial shopping complex. Commercial shopping complexes are important for customers need. It is important to study Qualitative risk assessment & project time management tools & techniques on commercial shopping complex. So the effect of Qualitative risk assessment with respect to impact of project time management tools & techniques on site of old commercial shopping complex is found.

3. CASE STUDIES

Case study 1:

Data:

Built up area: Approx. 4580 Sq. m.

Built up floors: Lower level stilt parking / Upper level stilt parking (Lower ground floor) / Upper level ground floor / First floor / Second floor / Third floor / Fourth floor

No. of units: 116

No. of lift: 4

External plaster: Complicated

External paint: Complicated

Plumbing work: Simple

Basement: Yes (Depth –1.22m)

Excavation: Yes (as per sloping plot)

Electrical work: Complicated

Observations:

Table 2: Types of Risk factors Health hazard as per Qualitative risk assessment, Case 1

High risk	- Unsafe excavation as per sloping plot - Unsafe as per Basement depth is high
Medium risk	- Moderate use of mobile crane - Moderate used machinery
Low risk	- Safe as per corner access - Safe as per fire fitting as easy access. - Safe as per External plaster - Safe as per External paint - Safe as per easy plumbing

Case study 2:

Data:

Built up area: Approx. 2695 Sq. m.

Built up floors: Basement parking floor / Lower ground floor / Upper ground floor / First floor / Second floor / Third floor / Fourth floor

No. of units: 53

No. of lift: 2

External plaster: Not so complicated

External paint: Not so complicated

Plumbing work: Simple

Basement: Yes (Depth – 4.26m)

Excavation: Yes (Deep)

Electrical work: Old work so complicated

Observations:

Table 3: Types of Risk factors Health hazard as per Qualitative risk assessment, Case 2

High risk	- Unsafe excavation as per sloping plot - Unsafe as per Basement depth is high
Medium risk	- Moderate use of mobile crane - Moderate used machinery
Low risk	- Safe as per corner access - Safe as per fire fitting as easy access. - Safe as per External plaster - Safe as per External paint - Safe as per easy plumbing

Case study 3:

Data:

Built up area: Approx. 1606Sq. m.

Built up floors: Basement parking floor / Ground floor / First floor

No. of units: 53

No. of lift: 1

External plaster:-Only till first floor heighted so easy work

External paint: Sheets used.

Plumbing work: Simple

Basement: Yes (Depth – 2.60m)

Excavation: Yes (not so deep)

Electrical work: Old work so complicated

Observations:

Table 4: Types of Risk factors Health hazard as per Qualitative risk assessment, Case 3

High risk	- Unsafe as per Basement depth
Medium risk	- Moderate use of mobile crane - Moderate used machinery
Low risk	- Safe as per corner access - Safe as per External plaster - Safe as per sheets used accept paint - Safe as per easy plumbing

Case study 4:

Data:

Built up area: Approx. 1510Sq. m.

Built up floors: Basement parking floor / Lower ground floor / Ground floor / First floor / Second floor/ Third floor/ Fourth floor/ Fifth floor

No. of units: 52

No. of lift: 2

External plaster: Complicated

External paint: Complicated

Plumbing work: Simple

Basement: Yes (Depth – 4.32m)

Excavation: Yes (Deep)

Electrical work: Latest equipment used

Observations:

Table 5: Types of Risk factors Health hazard as per Qualitative risk assessment, Case 4

High risk	- Unsafe scaffolds for External plastering - Unsafe working at height External paint - Unsafe as per Basement depth
	- Unsafe space from all margin
Medium risk	- Moderate use of mobile crane - Moderate used machinery
Low risk	- Safe as per corner access - Safe as per easy plumbing

Common observation in Cases 1 to 4:

It is found that there is unawareness and improper use of following Project time management tools & techniques on site before, during & after construction work.

1. Work breakdown structure
2. Bar chart (Gantt chart)
3. Linked bar chart
4. Critical path method
5. Resource leveling & resource smoothing
6. Schedule crashing & fast tracking
7. Schedule updating
8. Program Evaluation & Review technique (PERT)

Implications:

- From above case studies it is found that in medium risk same problems are found which were controlled.
- In two case studies, Case 1 & 4, it is found that risks are high as compared to Case 2 & 3.
- In another two case studies, Case 2 & 3, it is found that risks are low as compared to previous two case studies.
- Floor height of Case 3 (three floor) is less as compared to another case studies so it is safe for external work for example external plaster, external paint. So less building height remains less risk for site worker.
- Case 1 & 4 are more heighted buildings as compare to other case studies. So it is difficult to external plaster & paint.
- In Case 1 upper two floors & one lift are constructed after 5 years so it was high risk constructing building.

4. RESULTS & DISCUSSION

4.1 Data Analysis for Questionnaire – Type 1

Table 6: Data Analysis

Q. No.	Que.	Response	NO	Some-what	YES	Total	Hypothesis testing					
							Sample size	Sample Mean	Sample Variance	|Z| (5% level of significance)	Value of the power	Result
1	Do you know Construction project management?	No. of Respondents	1	18	21	40	40	2.5	0.3076	5.70	'P'< 0.00001	significant as P<0.05
		%	2.50	45.00	52.50	100						
1.1	If Yes, do you practice it?	No. of Respondents	24	-	15	39	-	-	-	-	-	-
		%	61.54	-	38.46	100						
Hence according to the user respondents, they have significant knowledge of Construction project management.												
2	Do you know project time management?	No. of Respondents	3	15	22	40	40	2.475	0.409	4.69	'P'< 0.00001	significant as P<0.05
		%	7.50	37.50	55.00	100						
2.1	If Yes, do you practice it?	No. of Respondents	28	-	9	37	-	-	-	-	-	-
		%	75.68	-	24.32	100						
Hence according to the user respondents, they have significant knowledge of project time management.												
3	Do you know project time management tools & techniques?	No. of Respondents	5	15	20	40	40	2.38	0.497	3.36	'P' = 0.00039	significant as P<0.05
		%	12.50	37.50	50.00	100						
3.1	If Yes, do you practice it?	No. of Respondents	27	-	8	35	-	-	-	-	-	-
		%	77.14	-	22.86	100						
Hence according to the user respondents, they have significant knowledge of project time management tools &techniques.												
4	Which of the time management tools & techniques do you know?	No. of Respondents	5	9	26	40	-	-	-	-	-	-
		%	12.50	22.50	65.00	100						
5	If Yes, do you practice it?	No. of Respondents	NO	-	YES	Total	-	-	-	-	-	-
			22		18	40						
		%	55.0	-	45.0	100						

			0		0								
Hence according to the user respondents, they have significant knowledge of Construction project management.													
Q. No.	Que.	Response	Up to 25%	25-50%	50-75%	75-100%	Total	Hypothesis testing					
								-	-	-	-	-	-
6	Which percentage do you prefer for above tools & techniques for beneficial use?	No. of Respondents	4	5	6	3	18	-	-	-	-	-	-
		%	22.20	27.78	33.33	16.67	100						

Q. No.	Que.	Response	NO	Some-what	YES	Total	Hypothesis testing					
							Sample size	Sample Mean	Sample Variance	|Z| (5% level of significance)	Value of the power	Result
7	Do you know that improper use of tools& techniques gets impact on – quality work onsite?	No. of Respondents	5	15	20	40	-	2.375	0.496795	-	-	-
		%	12.5	37.5	50	100						
7.1	If Yes, I am taking partly practice on tools &techniques	No. of Respondents	28	-	9	37	-	-	-	-	-	-
		%	75.68	-	24.32	100						
8	risk?	No. of Respondents	7	15	18	40	-	2.275	0.563462	-	-	-
		%	17.50	37.50	45.00	100						
8.1	If Yes, I am taking partly practice on tools &techniques	No. of Respondents	24	-	9	33	-	-	-	-	-	-
		%	72.73	-	27.27	100						
9	time overrun?	No. of Respondents	7	15	18	40	-	2.325	0.430128	-	-	-
		%	17.50	37.50	45.00	100						
9.1	If Yes, I am taking partly practice on tools &techniques	No. of Respondents	19	-	17	36	-	-	-	-	-	-
		%	52.78	-	47.22	100						

10	cost overrun?	No. of Respondents	4	19	17	40	-	2.375	0.394231	-	-	-
		%	10.00	47.50	42.50	100						
10.1	If Yes, I am taking partly practice on tools &techniques	No. of Respondents	20	-	17	37	-	-	-	-	-	-
		%	54.05	-	45.95	100						

4.2 Data Analysis for Questionnaire – Type 2

Q. No.	Que.	Response	NO	Some-what	YES	Total	Hypothesis testing					
							Sample size	Sample Mean	Sample Variance	|Z| (5% level of significance)	Value of the power	Result
11	Do you know hazard & risk on construction site?	No. of Respondents	1	10	29	40	40	2.70	0.2667	8.57	'P'< 0.00001	significant as P<0.05
		%	2.50	25.00	72.50	100						
11.1	If Yes, do you practice it?	No. of Respondents	31	-	8	39	-	-	-	-	-	-
		%	79.49	-	20.51	100						
Hence according to the user respondents, they have significant knowledge about hazard& risk on construction site.												
12	Do you know hazard & risk gets affected on time management tools& techniques?	No. of Respondents	7	9	24	40	40	2.425	0.6096	3.44	'P' = 0.00091	significant as P<0.05
		%	17.50	22.50	60.00	100						
12.1	If Yes, do you practice it?	No. of Respondents	25	-	8	33	-	-	-	-	-	-
		%	75.76	-	24.24	100						
Hence, according to the user respondents, they have significant knowledge of hazard & risk gets affected on time management tools& techniques.												
13	Do you know what risk assessment is?	No. of Respondents	9	16	15	40	40	2.15	0.5923	1.23	'P' = 0.109	significant as P>0.05
		%	22.50	40.00	37.50	100						
13.1	If Yes, do you practice it?	No. of Respondents	24	-	7	31	-	-	-	-	-	-
		%	77.42	-	22.58	100						

Hence, according to the user respondents, they do not have significant knowledge about risk assessment.

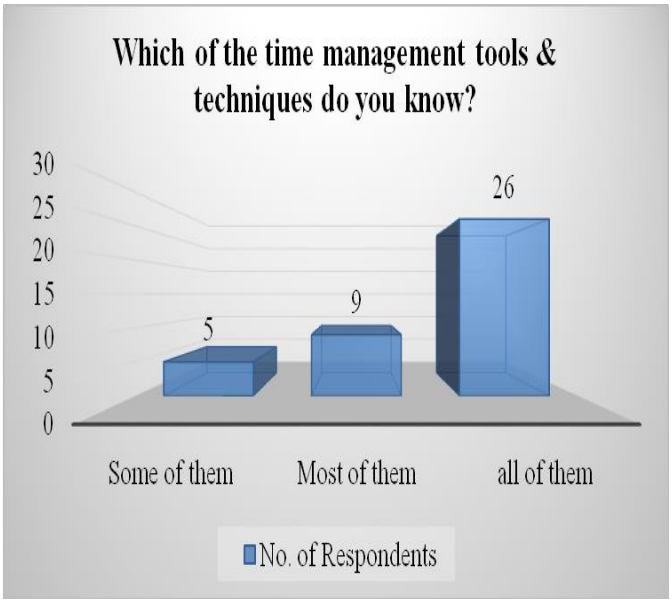
Q. No.	Que.	Response	NO	Some-what	YES	Total	Hypothesis testing					
							Sample size	Sample Mean	Sample Variance	|Z| (5% level of significance)	Value of the power	Result
14	Do you know about qualitative risk assessment?	No. of Respondents	12	19	9	40	40	1.925	0.532	-0.65	'P' = 0.2578	significant as P>0.05
		%	30.00	47.50	22.50	100						
14.1	If Yes, do you practice it?	No. of Respondents	28	-	6	34	-	-	-	-	-	-
		%	82.35	-	17.65	100						
Hence, according to the user respondents, they do not have significant knowledge about qualitative risk assessment.												
15	Do you know about health & safety of well-trained labor are important in qualitative risk assessment?	No. of Respondents	5	10	25	40	40	2.5	0.513	4.42	'P' < 0.00001	significant as P<0.05
		%	12.50	25.00	62.50	100						
15.1	If Yes, do you practice it?	No. of Respondents	27	-	8	35	-	-	-	-	-	-
		%	77.00	-	23.00	100						
Hence, according to the user respondents, they have significant knowledge about health & safeties of well-trained labor are important in qualitative risk assessment.												
16	Do you know in construction of commercial shopping complex; quality of work is partly dependent on qualitative risk assessment?	No. of Respondents	13	8	19	40	40	2.15	0.797	1.06	'P' = 0.144	significant as P>0.05
		%	32.50	20.00	47.50	100						
16.1	If Yes, do you practice it?	No. of Respondents	23	-	4	27	-	-	-	-	-	-
		%	85.19	-	14.81	100						
Hence, according to the user respondents, they do not have significant knowledge that in construction of commercial shopping complex, quality of work is partly dependent on qualitative risk assessment.												

Q. No.	Que.	Response	NO	Some-what	YES	Total	Hypothesis testing					
							Sample size	Sample Mean	Sample Variance	|Z| (5% level of significance)	Value of the power	Result
17	Do you know qualitative risk assessment gets affected on tools& techniques?	No. of Respondents	11	14	15	40	40	2.10	0.6564	1.06	'P' = 0.217	significant as P>0.05
		%	27.50	35.00	37.50	100						
17.1	If Yes, do you practice it?	No. of Respondents	27	-	2	29	-	-	-	-	-	-
		%	93.10	-	6.90	100						
Hence, according to the user respondents, they do not have significant knowledge about qualitative r isk assessment gets affected on tools & techniques												
18	Do you know implementation of qualitative risk assessment is important on construction of commercial shopping complex?	No. of Respondents	9	11	20	40	40	2.275	0.666	2.13	'P' = 0.0165	significant as P<0.05
		%	22.50	27.50	50.00	100						
18.1	If Yes, do you practice it?	No. of Respondents	28	-	3	31	-	-	-	-	-	-
		%	90.32	-	9.68	100						
Hence, according to the user respondents, they have significant knowledge about implementation of qualitative risk assessment is important on construction of commercial shopping complex.												

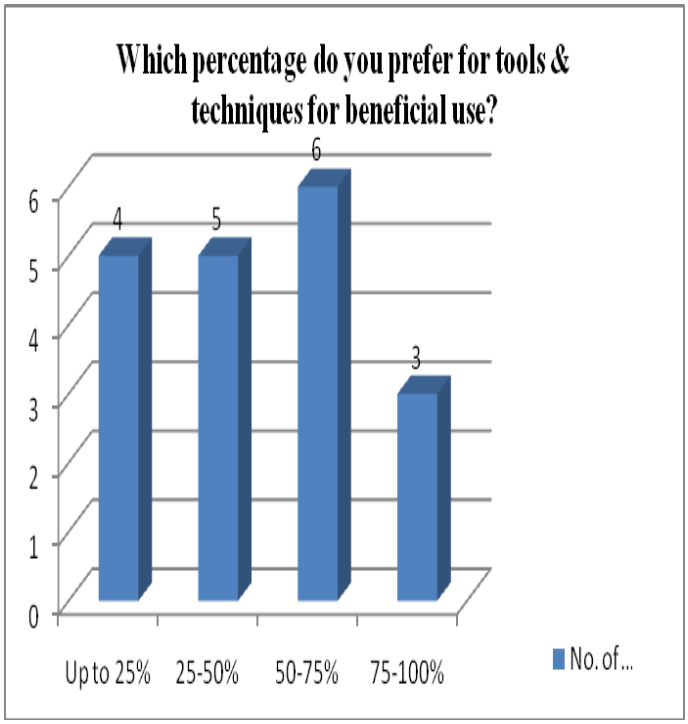
Q. No.	Que.	Response	Up to 25%	25-50%	50-75%	75-100%	Total	Hypothesis testing					
								-	-	-	-	-	-
19	Which percentage do you prefer for qualitative risk assessment?	No. of Respondents	7	11	8	14	40	-	-	-	-	-	-
		%	17.50	27.50	20.00	35.00	100						

Q. No.	Que.	Response	NO	Some-what	YES	Total	Hypothesis testing					
							Sample size	Sample	Sample Variance	|Z| (5% level	Value of the	Result

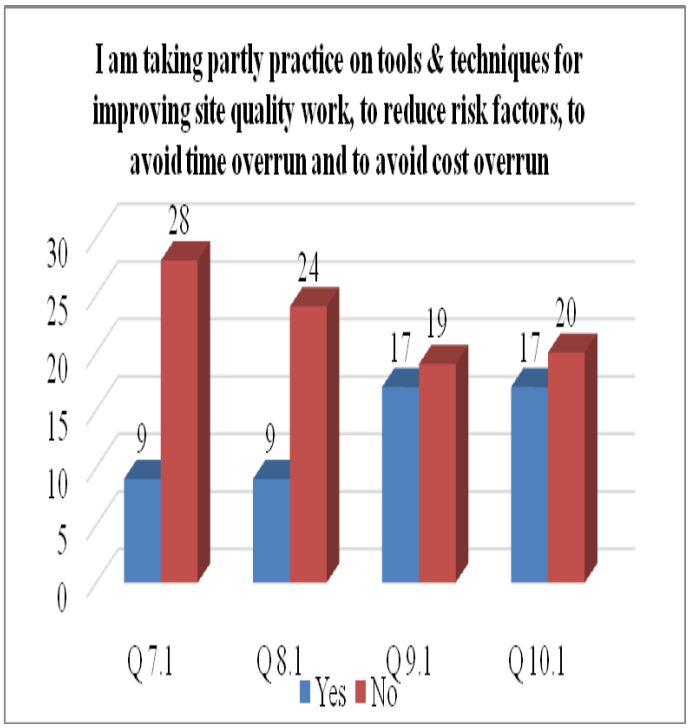
								Mean	e	of significance)	power	
20	Do you know effect of qualitative risk assessment gets impact on fast decision on commercial construction work?	No. of Respondents	8	8	24	40	40	2.4	0.65641	3.12	'P' = 0.000901	significant as P<0.05
		%	20.00	20.00	60.00	100						
20.1	If Yes, do you practice it?	No. of Respondents	28	-	4	32	-	-	-	-	-	-
		%	87.50	-	12.50	100						
Hence, according to the user respondents, they have significant knowledge about effect of qualitative risk assessment gets impact on fast decision on commercial construction work.												
21	Do you fill up risk assessment form on construction site?	No. of Respondents	23	-	17	40	-	-	-	-	-	-
		%	57.5	-	42.5	100						
22	Do you know risk matrix?	No. of Respondents	16	20	4	40	40	1.7	0.4201	-2.93	'P' = 0.001695	significant as P<0.05
		%	40.00	50.00	10.00	100						
22.1	If Yes, do you practice it?	No. of Respondents	21	-	3	24	-	-	-	-	-	-
		%	87.50	-	12.50	100						
Hence, according to the user respondents, they have significantly less knowledge about risk matrix.												



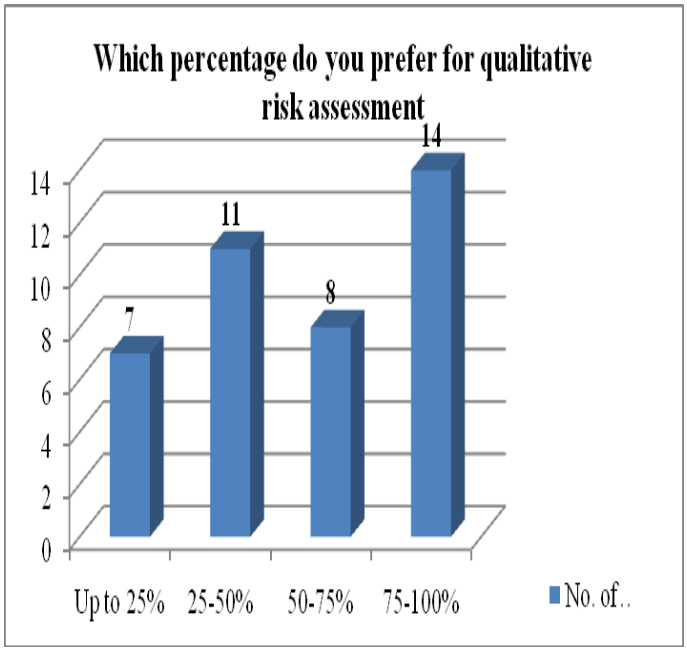
Graph 1: Preference of project time management tools & techniques(Ques.5)



Graph 2: Percentage of beneficial use for tools & techniques(Ques.6)



Graph 3: Practice on tools & techniques for i) improving site quality work, ii) to reduce risk factors, iii) to avoid time overrun and iv) to avoid cost overrun (Ques.7to10)



Graph 4: Percentage of preference for qualitative risk assessment(Ques.19)

5. CONCLUSIONS

Conclusion from Questionnaire:

In above data analysis it is found that percentage of knowledge & practice of qualitative risk assessment & project time management tools & techniques are very low. There are 30 questionnaire formed for taking analysis. Among 30 questionnaires 24 questions have their sub-questions. Out of 24 sub-questions it is found that percentage of 'Yes' response is less than 'No' response. It means that awareness & practice of project time management tools & techniques & qualitative risk assessment is very poor. Unawareness as well as less practice of quality, risk of qualitative risk management & project time management tools & techniques on construction site causes delay in time & cost. Qualitative risk assessment & time management tools & techniques on construction project are not implemented properly on site. The rules & guidelines are not properly framed for qualitative risk assessment & time management tools & techniques on construction site. Records & reports are not properly maintained on site. Peoples on site are somewhat know about project time management & its tools & techniques and qualitative risk assessment but not practicing it properly. Hazards & risks are controlled on site when qualitative risk assessment is on practice. All well trained labors should always be health & safety on construction site. Accidents in construction site will be minimized while qualitative risk assessment improved. Quality & speed of labor work improves in low risk assessment. Problems occur like time overrun, cost overrun, disputes, and litigation because of less practice of qualitative risk assessment on site. There should be awareness of qualitative risk assessment & time management tools & techniques, so that managerial staffs can get a clear understanding on time management & they are able to prevent them early.

Conclusion from case study:

In commercial shopping complex in case studies, it is found that more heighted building causes high risk & less heighted building causes less risk. Also latest equipment materials that are tools & techniques should be arranged during construction work. So before construction of commercial shopping complex future risks should be found. There should be planning for before, during & after construction work. It is found that more heighted commercial shopping complex that is Case 1 & 4 high risk is found. Case 3 has lowest risk as compared to remaining all case studies because it is low heighted building.

REFERENCES

[1] Sawalhi, N. E. and Enshassi, A., November 2012, "Application of Project Time Management Tools and Techniques to the Construction Industry in the Gaza Strip", The Australian Journal of Construction Economics and Building, Vol. 5, No. 1, pp. 1-8.

[2] Abbasi, G. and Al-Mharmah, H., 2000, "Project management by the public sector in a developing country", International Journal of Project Management, Vol.18, No.2, pp.105-109.

[3] Enshassi, A., 1997, "Site organization and supervision in housing project in the Gaza Strip", International Journal of Project Management, Vol.15, No.2, pp.93-99.

[4] Heiberg, M. and Øvensen, G., 1993, "A Survey of Living Conditions", FAFO Report, Palestine Society, Report 151.

[5] Hutchings, D.M. and Christofferson, J. P., 2000, "A study of management practices in small-volume home building companies", Proceedings of the ASC 36th Annual Conference, Purdue University, Indiana, pp. 211-220.

[6] Hutchings, D.M. and Christofferson, J. P., 2001, "Management practices of residential construction companies producing 25 and fewer annually", Proceedings of the ASC 37th Annual Conference, University of Denver, Colorado, pp. 115-121.

[7] Kazi, A.S., 2002, "Project planning and control parameter analysis", mail questionnaire.

[8] Palestine Economic Policy Research Institute, 2001, "Economic monitoring report", pp.1-22.

[9] Mezher, T. and Tawil, W., 1998, "Causes of delays in the construction industry in Lebanon", Engineering Construction and Architectural Management Journal, Vol.5, No.3, pp. 251-260.

[10] PECDAR Report, 1997, "Housing in Palestine".

[11] PCBS, 2000, "Number of enterprises and persons engaged for construction contractors (1995-1999)", The Palestinian Central Bureau of Statistics.

[12] Shash, A. and Al-abdullatif, A.M., 1993, "A survey of planning and controlling techniques used by construction contractors in Saudi Arabia", Cost Engineering, Vol.35, No.2, pp. 95-112.

[13] White, D. and Fortune, J., 2002, "Current practice in project management – an imperial study", International Journal of Project Management, Vol.20, No.3, pp.1-13.

[14] Dixit, S., 2018, TIME MANAGEMENT Book, Manjul Publishing House, First Edition.

[15] Ismail, I.B., Rahman, I.A., Memon, A.H., and Karim, A.T., 2013, "Comparative study on time management practices in construction industry between Kedah and Kelantan", Proceedings: the 2nd International Conference on Global Optimization and Its Applications, pp. 1-6.