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Effects of varying factors on performance of construction projects in terrorism hit areas of the world

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Construction projects have encountered poor performance due to the insecure environment caused by insurgency and terrorism in the world. The real cause includes lack of desired resource and reluctance of stakeholders/project teams to work in such areas. The project suffers a massive loss of finances, time overrun and poor quality which ends up the project in the midway. In the current research, various risks which affect the productivity of the project due to an insecure environment will be identified. Multiple factors are affecting the objectives of the project; time and cost will be extracted from the literature review and structured interviews from stakeholders who have already work experience in these areas. A model incorporating these factors will be developed. The model will further be validated and verified from the project which has been implemented in such areas. This study will help not only help in increasing the performance of the project but also set a yardstick for development projects implemented in insurgency-hit areas of the world.

Key words: Poor performance, time overrun, cost overrun, man-made disaster areas, terrorism, infrastructure development projects.

INTRODUCTION

Infrastructure development projects are complex in nature. Therefore, these are more prone to risks (Flyvbjerg et al., 2004). These risks are multiplied mani-folds if projects are implemented in man-made disaster areas in many parts of the world. There is a number of stakeholders in a project which includes consultant, client, contractor, local population, government ad-ministration (Ofori, 2002). Coordination amongst all to implement interconnected activities on ground compounded with terrorism and insurgency is an intricate preposition (Ran, 2011). This all results in delaying of the project with poor cost performance and compromised quality. Various risks have been identified by many researchers. These include physical, design, implemen-tation, legal, financial and political[4]. Projects are delayed and overshoot regarding cost due to stakeholders, material and equipment, labor, contractual relationship and many other factors (Ahsan and Gunawan, 2010). This paper will primarily focus on the poor performance of the project (time overrun and cost overrun) due to one single factor; insecure environment due to insurgency and terrorism which is considered as *Force Majeure* (Komendantova et al., 2012).Terrorism and insurgency in the various regions of the world, besides causing millions of deaths, have created insecurity amongst the people. This insecure environment has severely affected the performance of

construction projects. The resource is minimal regarding material and machinery due to the unwillingness of owners to send machinery to these areas. Stakeholders are not ready to work in terrorism-hit areas due to insecurity (life threats). A minimal literature review is available on project performance in terrorism-hit regions of the world.

RESEARCH MOTIVATION

There are immeasurable causalities in the world due to asymmetric warfare. The examples in the world include hundred thousand deaths in Iraq, Afghanistan, Pakistan, India, and many parts of Africa. The effects of terrorism can be measured by the Global Terrorism Index (GTI) Index (GT, 2015). The consequence of insurgencies in different countries can be measured and compared by using this tool. It also helps the Government to find out that how much insurgency has been contained in the state and either it is more or less in specific communities/factions. The index is derived from the measure of impacts (both direct and indirect) of insur-gency on the society Index GT, 2015). The implications may include casualties (both life lost and injuries), damage to the property, impacts on businesses and psychological effects on humans (Masciandaro, 2017). Figure 1 shows the Global Terrorism Index of various countries of the world. Most affected regions are South Asia, the Middle East and part of Africa (Masciandaro, 2017). Colour coding in the figure indicate the ranges of GTI. The countries with maroon color have GTI ranges from 6.76 to 10. Similarly, the states with light yellow color coding are least affected by the terrorism their GTI is less than 1.34. The countries with no color coding are not affected by terrorism which is very less.

The countries with the highest number of death casualties in 2016 are shown in Figure 2. Top five countries in the order of death toll are Iraq, Afghanistan, Syria, Nigeria and Pakistan. The law and order situation in these countries remained questionable. In some countries, after military operations, winning the hearts and minds of the people campaigns by uplifting the area was launched.

The campaigns mentioned above include the implementation of infrastructure development projects in affected areas. Initially, these are a quick impact later on projects with long terms impacts are launched (Coyne and Pellillo, 2011). Projects executed in man-made disaster areas are of different categories: roads, shingle tracks, schools/colleges, hospitals, water supply projects, provision of hand pumps, installation of tube wells and dug wells, development of children parks and underground water channels etc. (Perkins, 2016).

Resistive regions having insurgency are far flung from the best parts of the country. To restore peace, it is essential to bring these regions in line with the other parts of the country by carrying out development projects. Re-

construction is the last phase of any operation. The development projects implemented in various countries after carrying out operations by Law Enforcement Agencies are given in Table 1.

The projects implemented in these areas have poorly suffered owing to the insecure environment which results in poor performance of scope, time, cost and quality. After 9/11, Pakistan, Afghanistan and Iraq have suffered more than 200,000 casualties (both civilians and military) from over 40,000 bomb blast, more than 2,000 suicide bomber attacks. These incidences result in creating insecurity amongst stakeholders, affecting projects and bringing these at a halt during the execution stage. Frequent occurrences will create a dilemma for the project managers to complete these projects in time and cost with reasonably good quality. Therefore, project management skills become versatile as the security is the main focus during project management practice. The effects of insecure climate in which project teams work in the remote areas are the low yield of the project regarding cost, time and quality. There are some factors which affect the performance of infrastructure projects in insurgency-hit areas of the world. Five significant factors include environment of the area, social/cultural /ethnicity, economic condition, political factor and Institutional Factor. Military plays its vital role in these areas to stabilize law and order situation which favors the managers to improve the productivity of the projects. The effects of varying factors on the projects is represented using a fishbone diagram as given in Figure 3.

Research Objective

To identify the factors which affect the project productivity in troubled regions of the world due to terrorism concerning time and cost with the view to find out the order of importance of each factor.

Research contribution

The significance of this study was to investigate the leading causes of reduced productivity of the projects in man-made disaster areas of the world. The approach used to address this issue is novel. SPSS package is employed to identify the factors which affect the productivity of the projects.

RESEARCH DESIGN

The design of the study is prospective, retrospective and partially experimental. The survey is carried out by collecting data by using a self-administered questionnaire and structured interviews (Figure 4).

Theoretical Framework

An intense literature review was carried out to identify the factors/variables which affect the performance of the projects due to
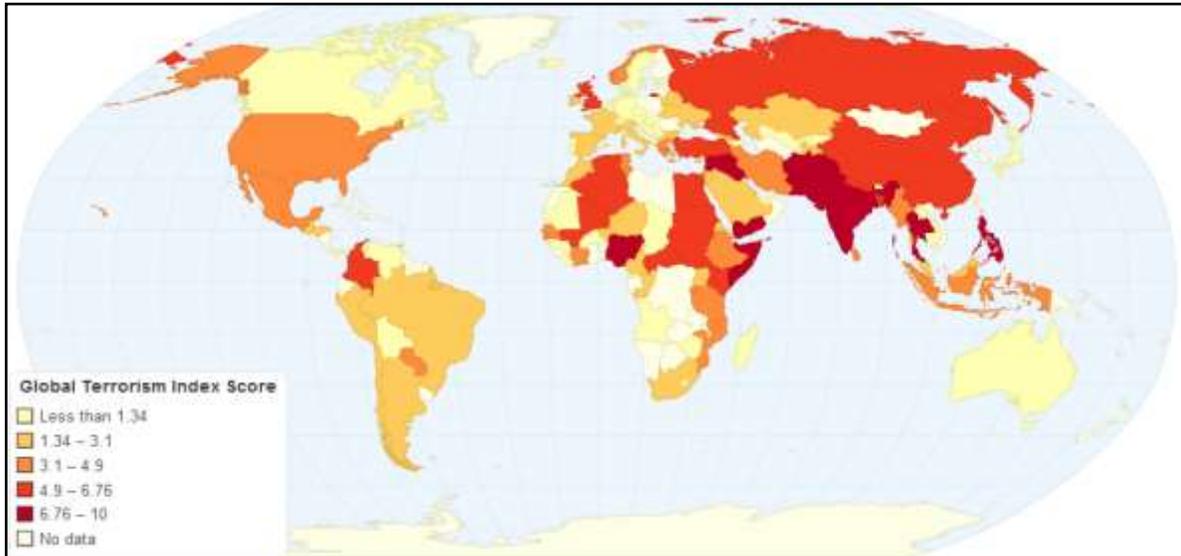
Figure 1. Map showing Global Terrorism Index (GTI) of various regions of the world in 2017(Masciandaro , 2017).
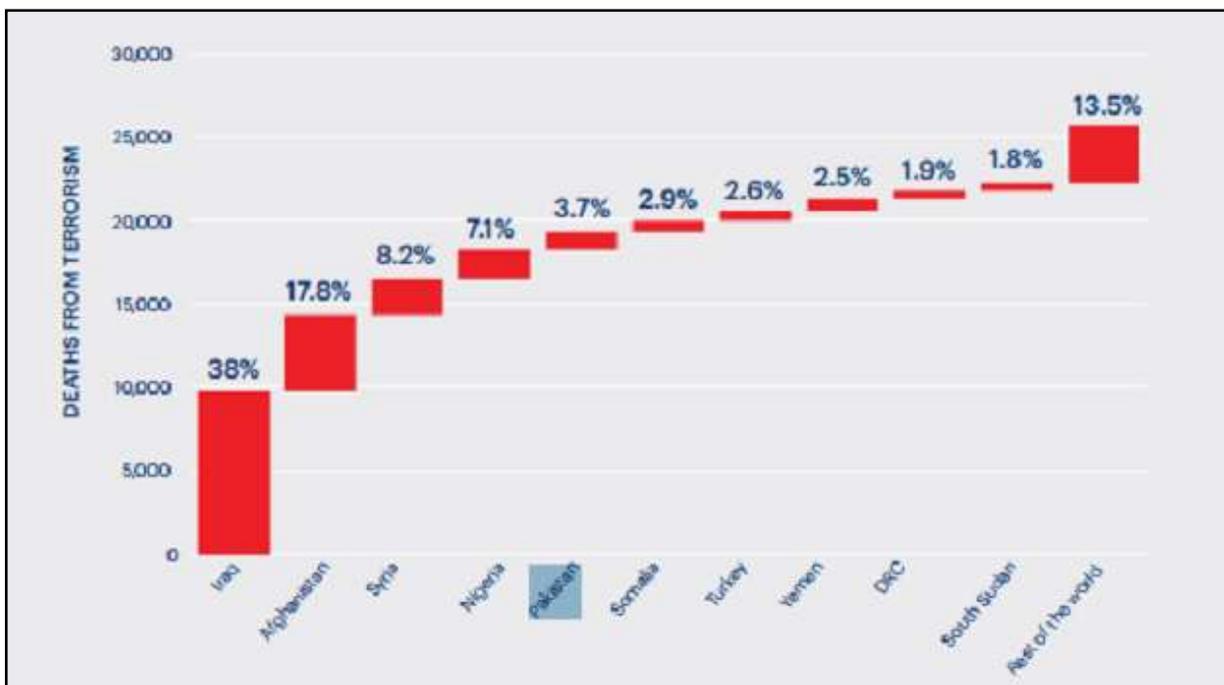Source: Masciandaro (2017).

Figure 2. Graph showing the death toll of top countries (in percentage) of the world in 2016
Source: Masciandaro (2017).

questionnaire incorporating all variables was developed and distributed to collect the data. Secondly, interviews of thirty-one stakeholders including representatives of consultants, clients, contractors and locals who are either from terrorism-hit areas or worked in these areas were conducted. The factors which affect the performance of the project both regarding time and cost due to an insecure environment owing to terrorism are given in Figure 5.

Research approaches

Mixed approach (quantitative and qualitative) were used (Neuman, 2013). The causes of low productivity of infrastructure projects mentioned in the fishbone diagram (Chang, 2015) helped in developing the questionnaire which ascertained the impacts of risk factor which are responsible for terrorism on construction projects.

Table 1. Infrastructure Development Projects Implemented in Terrorism Hit Regions of Pakistan, Afghanistan and Iraq.

Projects	Countries					
	Pak*	SL*	Afg*	India*	Iraq*	WA*
Road (all types) (km)	1015	965	1550	1750	1435	2015
Shingle tracks (km)	1610	1098	2015	3014	1765	3024
School / College buildings	121	97	201	250	345	440
Water supply projects	51	50	62	40	44	73
Hospitals / Health units	15	19	18	16	13	45
Tube wells/ Hand pumps/ Dug wells	6550	5643	7321	4430	5321	4325
Playing grounds / Parks	95	50	60	105	45	70
Underground water channels	15	18	10	20	9	35

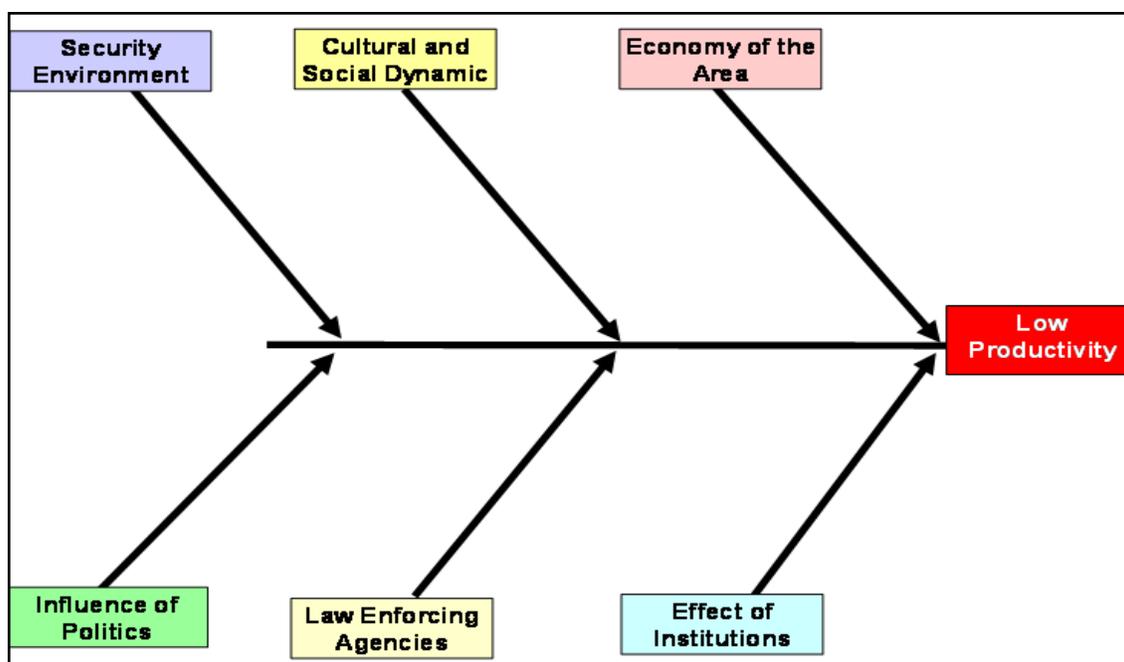*Pakistan, Sri Lanka, Afghanistan, India, Iraq, Western Africa.

Figure 3. Figure showing primary factors affecting the performance of the project in terrorism-hit areas
Source: Chang (2015).

The research will state that the questionnaire is fit for the purpose. To measure the risk criticality of each factor, the five-point Likert scale was used as shown in the table below.

Face/content validity of the research was carried out by three academics and four field experts. However, the construct validity of the project is verified through SPSS Package. Principal Component Analysis was employed to check the validity of inter-items (Kerzner and Kerzner, 2017).

The sample size of the population was kept flexible depending upon the judgment of the researcher. The sample was taken from terrorism affected areas of the world. The effects of terrorism have percolated almost every region of the country directly or indirectly. Therefore, it was decided to take the sample from all over the world depending upon the severity in each country (Croucher, 2018). The country-wise data of various terrorist acts is given in Table 2.

Based upon the terrorist incidents, different regions of the world

can be categorized as high risk, medium risk and low risk. Data was collected proportionately from each region depending upon a number of incidents. Keeping in view Table 3, primary data was collected from three countries; Pakistan, Afghanistan and Iraq. Western Africa has a substantial number of incidents, but it has more than 16 countries. The countries mentioned above can be categorized as: High Risk- Iraq; Afghanistan and Pakistan (70%); Medium Risk-India and Sirilanka (20%); Low Risk-Western Africa (10%).

The sample population constitutes stakeholders of infrastructure development projects which include clients, consultants, contractors, local population and government administration. The sample was collected as per the matrix is given in the Table 4.

The sample population was distributed and explained the questionnaire through detailed notes. A pilot study was carried out by keeping the sample size of 35 individuals. 345 questionnaires
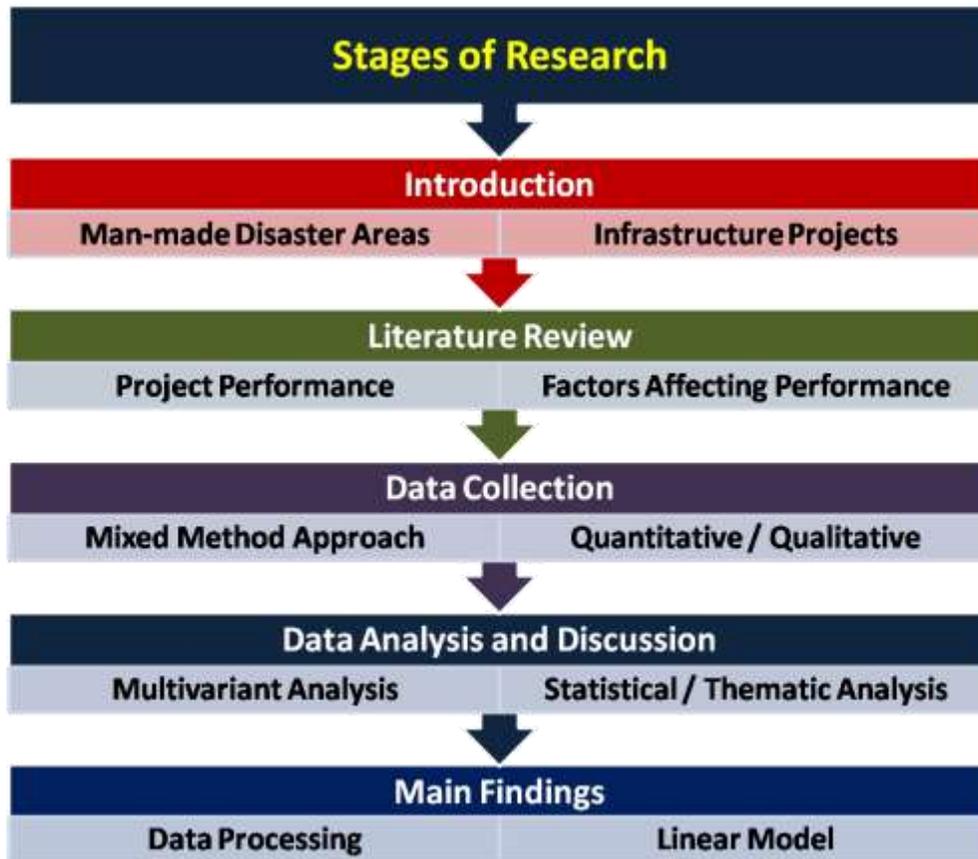
Stages of Research

Introduction

| Man-made Disaster Areas | Infrastructure Projects |

Literature Review

| Project Performance | Factors Affecting Performance |

Data Collection

| Mixed Method Approach | Quantitative / Qualitative |

Data Analysis and Discussion

| Multivariant Analysis | Statistical / Thematic Analysis |

Main Findings

| Data Processing | Linear Model |

Figure 4. Research stages leading to objectives of the study.

Table 2. Likert scale used to measure risk criticality.

Rating	Risk criticality
5	Most significant
4	More significant
3	Significant
2	Less significant
1	Very less significant

were distributed, and responses of 245 respondents were received.

Multi-variant analysis

Multi-variant analysis of collected data was carried out by processing it through SPSS package (Green and Salkind, 2016). Following tests were employed as under:

1. Reliability Analysis (RA).
2. Principal Component Analysis (PCA).
3. Sample population mean.
4. Standard Deviation (Std Dvn).
5. Relative Importance Index (RII).

RESULTS AND ANALYSES

Reliability analysis

Reliability analysis was carried out to check the internal consistency of the data received from various respondents (Tavakol and Dennick, 2011). Internal consistency of each scale was assessed and analyzed using the SPSS package. Value of Cronbach's alpha (overall) = 0.876. Time overrun = 0.895, Cost Overrun = 0.896. The value of Cronbach alpha is more than 7 which means data is reliable.

Table 3. Year wise terrorist incidents in different terrorism affected countries of the world.

Year	Countries					
	Pak*	SL*	Afg*	India	Iraq	WA*
2006	250	119	363	233	352	315
2007	280	201	452	313	472	314
2008	291	213	551	243	313	344
2009	340	254	601	213	311	302
2010	338	210	360	223	295	323
2011	331	167	413	343	432	322
2012	252	176	333	203	470	312
2013	273	201	412	201	317	333
2014	284	185	404	239	322	331
2015	211	210	401	313	350	310
2016	191	113	296	243	353	318
2017	150	115	398	123	351	302
Total	3191	2164	4984	2090	4338	3826

*Pakistan, Sri Lanka, Afghanistan, Western Africa.

Table 4. Sample matrix.

Country	Client	Contractor	Consultant	Locals	Government administration
Pak* (25%)	25	25	25	15	10
SL* (10%)	27	31	27	10	5
Afg* (25%)	25	25	25	15	10
India (10%)	27	31	27	10	5
Iraq (20%)	25	25	25	15	10
WA* (10%)	27	31	27	10	5

*Pakistan, Sri Lanka, Afghanistan, Western Africa.
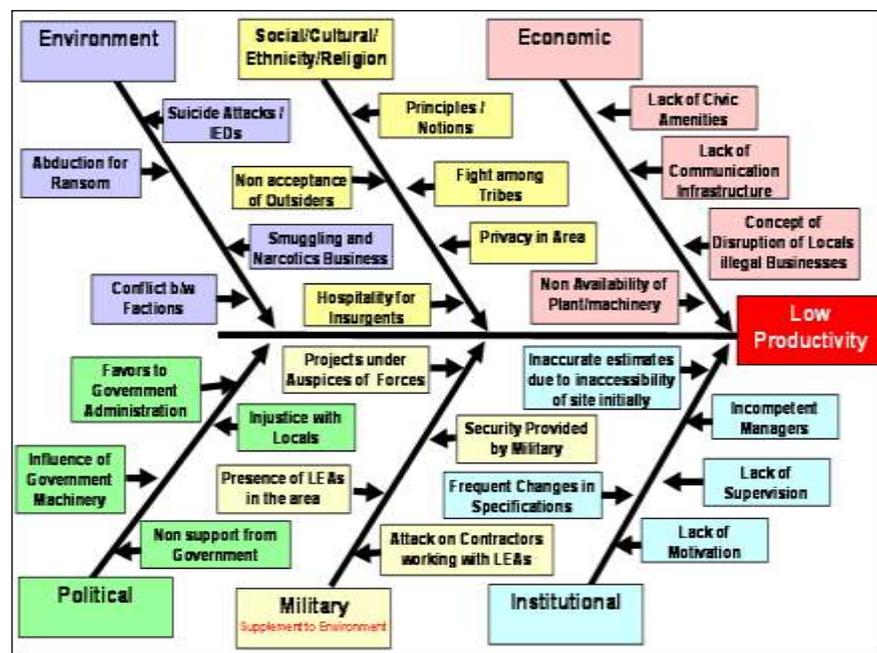
Figure 5. Figure showing both primary and secondary factors affecting the performance of the project in terrorism-hit areas.

The degree of importance of each identified risk

The risk/factor is given importance/ranking basing upon the mean score and their relative weight (Field et al., 2012). The weight of each variable is given in Table 5.

Knowledge-based model (KB)

KB model was developed using collected data by processing it through SPSS Package. The model is given below as:

$Z = 0.31 + 0.26A + 0.21B + 0.23C + 0.18D$

Where, Z = Project performance (cost, time will be calculated using unity method); A is overall environment due to security; B is the economy of the Affected Regions; C is social, cultural, ethnicity and religion; factor D is the effect of political factor.

The model can deviate 10%, which is acceptable. There can be three or four scenarios:

1) High-risk countries - Scenario A

In high-risk countries, where the insurgents have taken over control of the area. The writ of the government has been compromised. Operations by Law Enforcement Agencies (LEAs) are being planned.

In those regions, the values of factors may be taken as the maximum. Values of A =1, B=2, C=1.
$Z = 1.19 = 119\%$.

The above results mean that the cost of the project will increase 119 per cent in the worst case in high-risk countries. If the time of the project is 4 years and cost is 15 billion Rupees in settled areas than in worst case, the cost will increase up to 32.85 billion, and it will take 8.75 years to complete this project.

Medium risk countries - Scenario B

In medium risk countries, where the insurgents have taken over only the contested control of the area. In some areas, the writ of the government has been compromised. Operations by Law Enforcement Agencies (LEAs) are being carried out. Presence of forces has moved the terrorists away from the cities. Sporadic attacks in the form of improvised explosive devices are being carried out by terrorists. In those regions, the values of factors may be taken as the moderate. Values of A =0.5, B=0.5, C=0.5.
$Z = 0.75 = 75\%$.

The above results mean that the cost of the project will increase 75 per cent above in moderate conditions in medium risk countries. If the time of the project is 4 years and cost is 15 billion Rupees in settled areas than in worst case, the cost will increase up to 26.26 billion, and

it will take 7 years to complete this project.

Low-risk countries - Scenario B

In low-risk countries, where the Law Enforcement Agencies (LEAs) have taken over of the area. The writ of the government has resorted 80%. Operations by Law Enforcement Agencies (LEAs) has been carried out. Presence of forces has moved the terrorists away from the cities. Sporadic attacks in the form of improvised explosive devices are being carried out by terrorists. In those regions, the values of factors may be taken as the moderate. Values of A =0, B=0, C=0. $Z = 0.31 = 31\%$

The above results mean that the cost of the project will increase 31% above in moderate conditions in medium risk countries. If the time of the project is 4 years and cost is 15 billion Rupees in settled areas than in worst case, the cost will increase up to 19.65 billion, and it will take 5.24 years to complete this project.

Validation of Model

A case study of Road Project N-85 in Pakistan was taken by the researcher as a pilot study. Baluchistan Province is considered as the high-risk area of Pakistan. Owing to the adverse security environment, the scenario may be taken as antagonistic. The project was initially started in 2007 and was abandoned by the principal contractor due to political and security reasons. The project was restarted in 2010. The contract cost of the project is Rs 6.3 Billion and time is 3 years. The project was completed in Rs 14.5 Billion and completion time is 6.5 years. The difference in %age cost and time is 115 and 123 respectively. Also per model, the cost should be 119% more than the actual cost and similarly the time should reciprocate the same. There is 8% variation in cost and 3% variation in time. 10% variation is acceptable. Hence, the model is verified and validated.

CONCLUSIONS AND RECOMMENDATIONS

Minimizing terrorism and insurgency- Managing Risk

The terrorism hit countries of the world have adverse effects on the construction industry. The projects face delays owing to frequent stoppages due to damages to personnel and material. The decrease in terrorist acts will improve the performance of the project both time and cost wise. The insurgent's activities need to be checked. The projects are to be implemented under the umbrella of Law Enforcing Agencies (LEAs). This will give better performance results.

Gaining local population support

Lack of inhabitants support will have adverse effects on

Table 5. Mean score and degree of importance of each factor (n=26).

Risks / Factors	Mean	Std Dvn	RII	Rank
Overall environment due to security				
Project stoppages due to terrorist actions	4.76	0.5	0.94	1
Periodic changes in scope and site both	4.1	0.93	0.75	25
Repair / Reworks due to intense insurgent activities	4.60	0.54	0.90	3
Kidnappings for ransom	4.55	0.91	0.90	4
Threats to project teams	4.41	0.81	0.87	10
Re-contracting due to leaving of the site by contractors	4.36	0.80	0.86	11
The economy of the affected regions				
Overstretched chain supply	4.26	1.04	0.84	15
Usage of old vintage plant machinery and equipment	4.50	0.72	0.89	5
Skilled labor Deficiency	4.24	1.06	0.83	16
The unwillingness of proficient contractors to work	4.27	1.05	0.86	13
Delays in reaching material at the site	4.27	0.90	0.86	12
Delays in reaching plant and machinery at the site	4.49	0.73	0.89	6
Social, cultural, ethnicity and religion factor				
Altered work scope due to locals	4.26	1.05	0.85	14
Indecisiveness by project managers	4.5	0.77	0.88	8
Less acceptability of allied contractors	4.67	0.53	0.88	7
Inhabitants interference	4.20	1.00	0.82	18
The dispute between Managers and inhabitants of the area	4.46	0.79	0.87	9
Lack of inhabitants support	4.65	0.73	0.93	2
Effects of institutional factor (consultant and client)				
Inaccurate estimation due to inaccessible locations	4.11	1.11	0.79	21
Overambitious Planning due to inexperience	4.06	0.90	0.78	22
Frequent design changes	4.04	0.91	0.77	23
Infrequent visits on sites by consultant resulting in untimely inspections	4.16	1.01	0.81	19
Limited pool of contractors	4.23	0.93	0.83	17
Lack of willing Project managers	4.15	1.13	0.80	20
Effect of political factor				
Indecisive Government Administration	4.04	1.12	0.76	24
Unambiguous Requirements of Government Administration	4.1	0.93	0.75	26

the performance of the projects. To understand and then respect the culture of the locals is vital for the project managers to work in these areas. Winning the hearts and minds, campaigns though will cost something but will make the task of the project managers easier. The locals will be asking demands to let the project teams work. Demands involving minimal cost compared with the overall cost of projects may be met to generate a good will. Local people must be included in the project in the form of petty contractors and laborers.

Repairs / reworks due to intense insurgent activities

Owing to insurgent activities, a lot of time is wasted to carry out the re-works. A party comprising all types of tradesmen is detailed to take on the affected works.

Damaged works take more time than new construction. Thus the performance of the projects is affected. The completed projects or activities must be taken over by the local administration and can be further handed over to the concerned department for preservation.

The kidnapping of contractor teams for ransom

The insurgents kidnap contractors and members of project teams due to two reasons. One; to deter, so that project teams abandon the project. Second; kidnapping for ransom.

In both ways, the performance of the projects is affected. The project must incorporate some of the se-curity paraphernalia. The members of the project teams

teams must have a collective plan for moving in and out of the project site.

Usage of old vintage plant machinery and equipment

The plant machinery contractors are reluctant to bring new equipment in man-made disaster areas. There is no option except to use the old vintage plant. There is a number of breakages. Maintenance of plant and equipment in these areas is an arduous task. Virtually the productivity of the projects is reduced. Projects are delayed and also not cost effective. It is recommended to give incentives to the machinery owners regarding cost so that they bring better-advanced machinery.

Managing long logistic chain

The insurgent affected areas are far flung from major cities. Deliberate efforts are required to mobilize plant and machinery in the project area. The plant is needed to be moved under protection from a specific area. If hired machinery is to be brought in, the safety of equipment will pay rich dividends in attracting other owners of machinery.

Managing locals to accept allied contractors

Locals do not accept allied contractors. They want themselves to be incorporated into projects in any capacity. The allied contractors are not conversant with the local culture. The local people do not have expertise and capital to become outsourced contractors. Therefore, to improve the performance of the project, it is recommended to either incorporate the locals in the project with outsourced contractors as employees or as a petty contractor.

Decision making by project managers

The managers working in insecure environments remain indecisive due to the impromptu situation. The decision should be taken by the managers by bringing all stakeholders on board. A bold and firm decision is expected from managers all level to execute projects in time and within contract cost.

LIMITATIONS OF RESEARCH

The study was carried out in terrorism/insurgencies hit areas of the world. The data was collected from different stakeholders who have actually worked in these areas. Basing upon this data, results were drawn by processing the data in a Package. Although, the sample was gathered from different parts of the world which represents

diverse cultures so the results may be inflated owing to common source bias.

Conclusion

Owing to an insecure environment, productivity (time and cost) of infrastructure development projects are likely to be affected. Varying factors contributing to the low performance of the project was identified, studied and analyzed. In previous studies effects of insecurity due to insurgency has been considered as force majeure and no worthwhile study has been conducted earlier. Twenty-six factors were identified from the detailed literature review and opinion of experts. The data was collected from a sample population through a structured questionnaire. The gathered information was processed, and the weight of each variable was ascertained. All variables were ranked keeping in view the weight. Top eight variables were discussed, conclusions drawn and recommendations are made. The findings of this study will facilitate in improving the performance of the projects in terrorism-hit areas of the world. For future research, the common factors which affect the performance of projects executed in any environment must also be clubbed with the factors due to terrorism and insurgency. A wholesome new model will be formulated which will help project managers to improve the performance of projects incorporating all types of factors.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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